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N.Y. Belt. & Pack. Co., Ltd., N. Y. City.
Air Brake Regulator
Mason Regulator Co., Boston.
Air Compressors & Rock Drills
Ingersoll-Sergeant Rock Drill Co., 10 Park Place, N. Y.
Rand Drill Co., 23 Park Place, N. Y.
Architects
Bradford L. Gilbert, 80 Broadway, N. Y.
Architectural Iron Work
Berlin Iron Bridge Co., East Berlin, Conn.
King Bridge Co., Cleveland, O.
Axles
Cambria Iron Co., Johnstown, Pa.
Lima Machine Works, Lima, O.
Louisville Steam Forge Co., Louisv., Ky.
Mich. Forge & Iron Co., Detroit, Mich.
Midvale Steel Co., Nicetown, Phila.
Pittsb'gh Forge & Iron Co., Pittsb., Pa.
T. Prosser & Son, 15 Gold St., N. Y.
Taylor Ir'n & St'l Co., High Bridge, N. J.
Balanced Slide-Valves
M. C. Hammett, Troy, N. Y.
Ballast Unloaders
Bucyrus (O.) Steam Shov. & Dredge Co.
Marion Steam Shovel Co., Marion, O.
Banners
Brown Bros. & Co., 59 Wall street, N. Y.
Bell Cord & Couplings
Samson Cordage Works, Boston, Mass.
Boilers
Abendroth & Root Mfg. Co., 28 Cliff St, N.Y.
Thos. Carlin's Sons, Allegheny, Pa..
C. W. Hunt Co., New York City.
Lidgerwood Mfg. Co., 96 Lib'ty St., N.Y.
Rich. Loco. & Mach. Co., Richmond, Va.
Boiler Fronts and Fittings
Vulcan Iron Works, Toledo, O.
Boiler Plate
Otis Steel Co., Ltd., Cleveland, O.
Schoenberger & Co., Pittsburgh, Pa.
Wellman Iron & Steel Co., Thurlow, Pa.
Boiler Scale Remover
Tyron Investment Co., N. Y. City.
Bolt Cutters
Acme Machinery Co., Cleveland, O.
Howard Iron Works, Buffalo, N. Y.
Bolts & Nuts
Fuller Bros. & Co., 139 Gr'nwich St., N.Y.
Books & Publications
John C. Trautwine, Jr.
Brake Adjusters
Hinckley Brake Co., Trenton, N. J.
Q. & C. Co., Chicago.
Brake Beams
American Brake B'm Co., Detroit, Mich.
Nat. Hollow Brake Beam Co., Chic., Ill.
Schoen Mfg. Co., Pittsburgh.
Brakes
Boyden Brake Co., Baltimore, Md.
Westinghouse Air-Brake Co., Pittsb., Pa
Brake-Shoes
Congdon Brake Shoe Co., Chicago, Ill.
Ramapo (N. Y.) Wheel & Foundry Co.
Bridges
Anderson & Barr, Jersey City, N. J.
Berlin Iron Bridge Co., E. Berlin, Conn.
Boston Bridge Works, Boston, Mass.
Chicago Bridge & Iron Co., Chicago, Ill.
Cofrode & Saylor, Philadelphia, Pa.
Detroit Bridge & Iron Wks, Det., Mich.
Edge Moor Bridge Wks, Wilmington, Del.
Elmira Bridge Co., Elmira, N. Y.
S. W. Frescoln, World Bldg., N. Y.
Louisville Bridge & Iron Co., Louisv., Ky.
Mo. Val. Br. & Ir. Wks., Leavenw., Kan.
Mt. Vernon Bridge Co., Mt. Vernon, O.
New Jersey Steel & Iron Co., Trenton.
Passaic Rolling Mill, Paterson, N. J.
Phœnixville Bridge Co., Phila., Pa.
Pittsburgh Bridge Co., 1105 Owings Bldg., Chicago.
Pottsville Bridge Co., Phila.
Rochester Bridge & Ir. W'ks, Rochester
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San Francisco Bridge Co., New York.
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Canda Mfg. Co., 11 Pine St., N. Y.
Reginald Canning & Co., 115 B'way, N.Y.
Ensign Mfg. Co., Huntington, West Va.
Erie Car Works (Limited), Erie, Pa.
Harvey Steel Car Co., Chicago, Ill.
Jackson & Sharp Co., Wilmington, Del.
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Hinson Car Coupler Co., Chicago, Ill.
Johnston Car Coupling Co., Phila., Pa.
McConway & Torley Co., Pittsburgh, Pa.
McGill Iron Works Co., Peoria, Ill.
Pratt & Letchworth, Buffalo, N. Y.
St. Louis Car Coupler Co., St. Louis, Mo.
Smillie Coupler & Mfg. Co., Newark, N. J.
Trojan Car Coupler Co., Troy, N. Y.
Van Dorston Ry. Sup. Co., Washt'on, D.C.
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Martin A. F. Car-Heat. Co., Dunkirk, N.Y.
Morton Safety Heating Co.
National Car Heating Co., Chicago.
Safety Car H. & Light Co., 160 B'way, N Y
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Stanley G. Flagg & Co., Philadelphia.
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Boston Belting Co., Boston, Mass.
N. Y. Belt. & Pack. Co., Ltd., N. Y. City.
Car Machinery
Greenlee Bros. & Co., Chicago.
Car Platform Gates
J. B. Goodwin, Providence, R. I.
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D. Goff & Sons, Pawtucket, R. I.
Car Replacers
Q. & C. Co., Chicago.
Car Roofing
Drake & Weirs, Cleveland, O.
C. B. Hutchins & Sons, Detroit.
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American Steel Wheel Co., N. Y. City.
Baltimore Car-Wheel Co., Balto., Md.
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Boles Steel Wheel Co., Scranton, Pa.
Bowler & Co., Cleveland.
Cayuta Wheel & Foundry Co., Sayre, Pa.
Cushion Car Wheel Co., Indianapolis.
Davenport & Fairbairn, Erie, Pa.
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N. Y. Car Wheel Works, Buffalo.
Thos. Prosser & Son, 15 Gold street, N.Y.
Ramapo Wheel & F'dry Co., Ramapo, N.Y.
Stand. Steel W'ks, 220 So. 4th St., Phila.
Taylor Iron & Steel Co., High Bridge, N.J.
Washburn Car-Wheel Co., Hartf'd, Conn.
Wason Mfg. Co., Springfield, Mass.
A. Whitney & Sons, Phila., Pa.
Car Window Balance
O. K. Gardner, Box 171, Pittsburgh, Pa.
Cattle Guards
Bush Cattle Guard Co., Kalamazoo, Mich.
Kalamazoo (Mich.) R.R. Veloc. & Car Co.
Merrill-Stevens Mfg. Co., Miles, Mich.
Wolhaupter, Benj., 39-43 Washington St., Chicago, Ill.
Chemists
Pittsb. Testing Laboratory, Pittsb., Pa.
Coal Chute
William, White & Co., Moline, Ill.
Consulting Engineers
D. L. Barnes, The Rookery, Chicago.
J. J. R. Croes, 13 William St., N. Y.
S. W. Frescoln, World Bldg., N. Y.
Geo. L. Fowler, 38 Broadway, N. Y.
A. Leofred, Quebec.
Albert Lucius, 71 Broadway, N. Y.
W. B. Parsons, 35 Broadway, N. Y.
Chas. Paine & Sons, 71 Broadway, N. Y.
F. H. Smith, 227 E. German St., Balto., Md.
J. A. L. Waddell, Kansas City, Mo.
Wilson Bros. & Co., Philadelphia, Pa.
Contractor
Mairs & Lewis, 18 B'way, N. Y.
Contractors' Cars
Thos. Carlin's Sons, Allegheny, Pa.
Contractors' Supplies
Port Chester (N. Y.) Wagon Co.
H. Channon Co., Chicago, Ill.
Conveyors
Link Belt Eng. Co., Nicetown, Phila.
Copper
Hendricks Bros., 40 Cliff street, N. Y.
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Industrial Works, Bay City, Mich.
John N. Poage, Cincinnati, O.
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R. D. Wood & Co., Philadelphia, Pa.
Yale & Towne Mfg. Co., Stamford, Conn.
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Crossing Gates
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Gorham Pneumatic Gate Co., Chic., Ill.
Jonson Eng. & Fdry. Co., N. Y. City.
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Blackmer Post, St. Louis Mo.
Cupola Furnaces
Victor Collian, Detroit, Mich.
Draft Rigging
Schoen Mfg. Co., Pittsburgh, Pa.
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Butler Drawbar Attach. Co., Cleveland.
Hinson Drawbar Attach. Co., Chicago
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San Francisco Bridge Co., Calif'rnia.
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Vulcan Iron Works, Toledo.
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Billings & Spencer Co., Hartford, Conn.
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Nat. Elect. Headlight Co., Indianapolis
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H. Ward Leonard & Co., New York.
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Keuffel & Esser, New York City.
Queen & Co., Philadelphia, Pa.
Young & Sons, Philadelphia, Pa.
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A. Leofred, Quebec.
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Industrial Works, Bay City, Mich.
A. S. Males & Co., Cincinnati, O.
Marion Steam Shovel Co., Marion, O.
Osgood Dredge Company, Albany, N. Y.
Vulcan Iron Works, Chicago.
Vulcan Iron Works, Toledo.
Explosives
Rendrock Powd. Co., 23 Park Place, N.Y
Feed-Water Purifier
Field Water Purifier Co., Chicago.
Arthur Pennell, Kansas City, Mo.
Fences
Barkly & House, Chicago, Ill.
Western Fence Co., Chicago, Ill.
Flexible Shafting
Stow Flexible Shaft Co., Phila., Pa.
Stow Mfg. Co., Binghamton, N. Y.
Fluoride
Amer. Fluoride Co., 126 Liberty St., N.Y
Freight Cars, Second Hand
New York Equip. Co., 15 Wall St., N. Y.
Freight Conveyors
Industrial Works, Bay City, Mich.
Forges
The Foos Mfg. Co., Springfield, O.
Furnaces
Abendroth & Root M. Co., 28 Cliff St., N.Y.
Frogs and Crossings
Allentown Rolling Mill, Allentown, Pa.
Cleveland (O.) Frog & Crossing Co.
Elliot Frog & Sw. Co., E. St. Louis, Ill.
Johnston R. R. Frog & Switch Co., Phila.
Kans. City Frog & Sw'ch Co., Kans. City
Pennsylvania Steel Co., Steelton, Pa.
Ramapo Iron Works, Hillburn, N. Y.
Union Switch & Signal Co., Pittsburgh.
Weir Frog Co., Cincinnati, O.
Gauges (Pressure)
Ashcroft Mfg. Co., 111 Liberty St., N. Y
Ashley Engineer Co., 135 Lib'ty st., N.Y
Guarantee Co.
Guarantee Co. of N. A., Montreal.
Hand Cars
The Buda Fdy & Mfg. Co., Harvey, Ill.
Fairbanks, Morse & Co., Chicago.
Kalamazoo (Mich.) R. R. Veloc. Co.
Sheffield Vel. Car Co., Three Rivers, Mich
Harbor Works
S. W. Frescoln, World Bldg., N. Y.
Highway Crossing Signals
Hall Signal Co., N. Y.
Johnson R. R. Signal Co., Rahway, N.J.
Union Switch & Sig. Co., Pitsb'rgh, Pa.
Hoisting & Conveying Machinery
Brown Hoisting & Conveying Mach. Co Cleveland, O.
C. W. Hunt Co., 45 B'way, New York.
King Bridge Co., Cleveland, O.
Lidgerwood Mfg. Co., 96 Lib'ty St., N.Y.
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Thos. Carlin's Sons, Allegheny, Pa.
Copeland & Bacon, New York City.
C. W. Hunt Co., New York City.
Industrial Works, Bay City, Mich.
Lidgerwood Mfg. Co., 96 Liberty St., N.Y
J. S. Mundy, Newark, N. J.
Vulcan Iron Works, Chicago.
Hollow Stay Bolt Iron
Falls Hollow Stay Bolt Co., Cuyahoga Falls, O.
Hydraulic Jacks
Richard Dudgeon, 24 Columbia St., N. Y.
Joseph F. McCoy Co., 26 Warren St., N.Y.
McSherry Mfg. Co., Dayton, O.
Watson & Stillman, 210 E. 43d St., N. Y.

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Detroit Lubricator Co., Detroit, Mich.
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Pittsb. Test. Laboratory, Pittsb., Pa.
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R. W. Hildreth & Co., 2 Wall St., N. Y.
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Wuerpel Sw. & Sig. Co., St. Louis, Mo.
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B. M. Jones & Co., Boston, Mass.
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Fairbanks, Morse & Co., Chicago.
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Illino s Alloy Co., Chicago.
Phosphor-Bronze Smelting Co., Philada.
Paul S. Reeves, Philadelphia, Pa.
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Menceely Bearing Co., W. Troy, N. Y.
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Railroad Lighting & Mfg. Co., Phila., Pa.
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Link Belt Eng. Co., Nicetown, Phila.
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Baldwin Locomotive Works, Philada.
Brooks Locomotive W'k's, Dunkirk, N.Y.
Cooke Loco. & Mach. Co., Paterson, N.J.
Dickson Mfg. Co., Scranton, Pa.
G. L. Fowler, 53 Broadway, N. Y.
Lima Machine Works, Lima, O.
A. S. Males & Co., Cincinnati, O.
N. Y. Equipment Co., 15 Wall St., N. Y.
Pittsburgh Loco. & Car Wks, Pittsburgh.
E. K. Porter & Co., Pittsburgh, Pa.
Portland Co., Portland, Me.
Richmond (Va.) Loco. & Mach. Works.
Rogers Loc. & Mach. Wks., Paterson, N. J.
Schenectady (N. Y.) Loco. Works.
Taite & Carlton, London, Eng.
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Geo. L. Fowler, 53 B'way, N. Y.
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Allison Mfg. Co., Philadelphia, Pa.
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Falls Hollow Staybolt Co., Cuyahoga Falls, O.
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National Mall. Castings Co., Cleveland.
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F. W. Devoe & Co., Fulton St., N. Y.
Jos. Dixon Crucible Co., Jersey City, N.J.
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Phosphor-Bronze Smelting Co., Phila.
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New York & New England R. R.
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Car Ventilator Co., Camden, N. J.
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Berlin Iron Bridge Co., E. Berlin, Conn.
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Skylights
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Nevens Flanger Co., Portland, Me.
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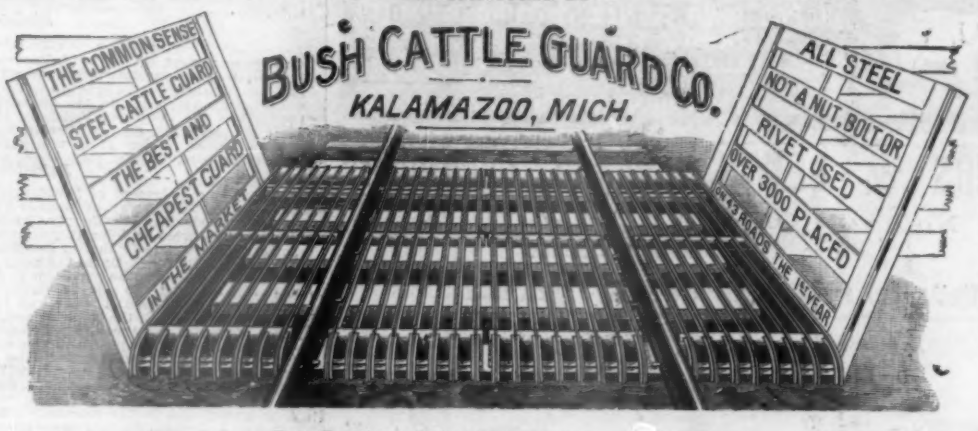

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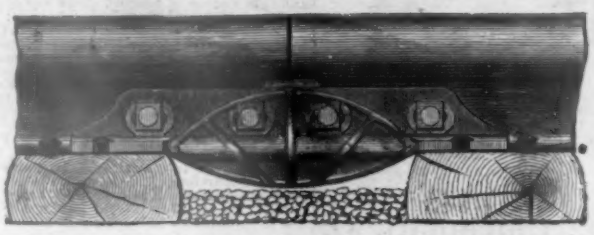

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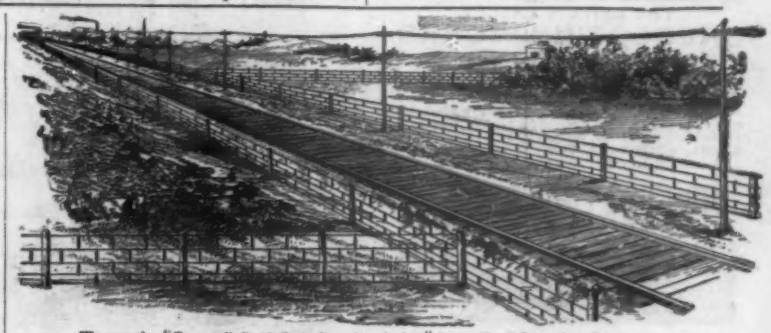

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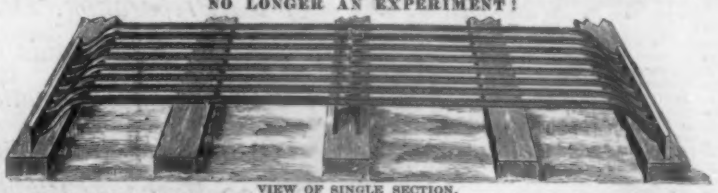

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Proposals for Dredging and Excavating, Sanitary District of Chicago.

TO CONTRACTORS.

Sealed proposals addressed to the Board of Trustees of the Sanitary District of Chicago and indorsed:

"*Proposals for excavating the main drainage channel*, will be received by the Clerk of said Sanitary District at Room H, Rialto building, Chicago, Ill., until 12 m. (standard time) of Wednesday, the 25th day of January, 1893, and will be publicly opened by the said Board of Trustees at the regular meeting held that day, or at a special meeting called for that purpose.

THE WORK FOR WHICH THE SAID TENDERS ARE INVITED IS THE EXCAVATION OF SECTIONS A, B, C, AND E OF THE MAIN DRAINAGE CHANNEL FOR THE SAID SANITARY DISTRICT BETWEEN WILLOW SPRINGS AND SUMMIT, ILL., AND THE DREDGING OF THE ILLINOIS AND MICHIGAN CANAL BETWEEN SUMMIT AND THE SOUTH FORK OF THE CHICAGO RIVER. Said work will consist in all of the excavation of about 7,200,000 cubic yards of earth, of about 95,000 cubic yards of rock, the building of 30,000 cubic yards of retaining walls, and the dredging of about 1,800,000 cubic yards of earth from that portion of the main channel comprised in the Illino's and Michigan canal between Summit and the south fork of the Chicago river.

Said work is divided into sections (the dredging of the Illinois and Michigan canal being one section), each of which will be treated as a separate contract in canvassing the proposals and making awards. As all awards will be made by individual sections as provided in the specifications and forms of proposals to be furnished bidders, each bidder must make price for each section separate and distinct from every other. The lumping of prices in any bid will render such bid informal and will cause its rejection by the said Board of Trustees.

Each proposal must be accompanied by a certified check or cash to an amount equal to $5,000 multiplied by the number of sections bid upon.

All certified checks must be drawn on some responsible bank doing business in the city of Chicago and be made payable to the order of the Clerk of the Sanitary District of Chicago. Said amount of $3,000 for each section will be held by the Sanitary District until all of said proposals have been canvassed and contracts awarded and signed, the return of said check or cash being conditioned upon any bidder to whom an award of any portion of said work may be made appearing within ten days after notice of such award being given, with bondsmen and executing a contract with the Sanitary District for the section or sections of said work so awarded and giving a bond satisfactory to the said Board of Trustees for the fulfillment of the same in the amount of $75,000 for each section of work awarded him.

All proposals must be made upon blank forms furnished by the Sanitary District and must give the price for each separate item of work.

The bids will be compared on the basis of the Engineer's approximate estimate of quantities, which will be furnished with copies of the specifications.

No proposal will be considered unless the party making it shall furnish evidence satisfactory to the Board of Trustees of his ability to do the work and that he has the necessary pecuniary resources to fulfill the conditions of the contract, provided such contract shall be awarded him.

Bidders are required to state in their proposals their individual names and places of residence in full.

Specifications and plans may be seen at the office of the Chief Engineer, Room D Rialto build ng, Chicago, Ill.

The said Board of Trustees reserves the right to reject any and all bids.

THE SANITARY DISTRICT OF CHICAGO,
By FRANK WENTER, President.
Attest: THOMAS F. JUDGE, Clerk.
Chicago, Nov. 25, 1892.

N. Y. Supreme Court, Dutchess County.

LEWIS H. VAIL, as trustee for the holders of the first-mortgage bonds of the Poughkeepsie, Hartford & Boston Railroad Company, *Plaintiff.*

Against

THE POUGHKEEPSIE, HARTFORD & BOSTON RAILROAD COMPANY, Edward Elsworth, individually and as mortgagee in a certain mortgage deed recorded in the office of the Clerk of the County of Dutchess, in Liber 156, pages 213, etc., of mortgages, and as trustee under such mortgage deed, and others, *Defendants.*

Pursuant to a judgment of foreclosure and sale granted on the 6th day of February, 1886, and entered in the Dutchess County Clerk's office in an action wherein John P. Adriance, as Trustee, etc., was plaintiff and the Poughkeepsie, Hartford & Boston Railroad Company and others were defendants (the said John P. Adriance having died and the said Lewis H. Vail having been substituted as Trustee and Plaintiff in said action), I, the undersigned, the Referee appointed by the said judgment for that purpose, will sell, at public auction at the east front door of the Court House in the City of Poughkeepsie, Dutchess County, New York, on Thursday, the 26th day of January, 1893, at twelve o'clock noon, the premises described in said judgment and in the mortgage therein referred to, and which are therein described as follows:

"All and singular, the railroad of the said Poughkeepsie, Hartford & Boston Railroad Company" (now known as the New York & Massachusetts Railway), "now or hereafter to be constructed, being about 47 miles long and extending from the Hudson River at the City of Poughkeepsie through, or as near as practicable, to the Villages of Salt Point, Stanfordville, Stissing and Pine Plains, in Dutchess County, and Boston Corners, in Columbia County, New York, to a point in the line between the States of New York and Connecticut, near the village of Millerton, in the State of New York, the said railroad connecting at that point with the Connecticut Western Railroad, together with all and singular the franchises of the said Poughkeepsie, Hartford and Boston Railroad Company, and its equipments property, tolls, rents, issues and profits, its lands, tenements, buildings, fixtures, machinery, rolling stock, goods and chattels connected with the operating of the said railroad, or appurtenant thereto, and all rails, ties, fencing and erections, right of way and easements, including all property, real and personal, now or hereafter to be acquired by the said Poughkeepsie, Hartford & Boston Railroad Company, either in law or equity, of what kind soever purtenant thereto.

"Excepting and reserving out of the above described premises and property that part thereof lying between Boston Corners and state line, a particular description of which is contained in a deed thereof made by Abram J. Rose, Referee to the Hartford & Connecticut Western Railroad Co., dated 1st of April, 1884, and recorded in the Dutchess County Clerk's office in Liber of Deeds 216, pages 468, etc., on the 5th day of April, 1884, and also recorded in the Columbia County Clerk's office in Liber of Deeds 76, pages 258, etc., on the 9th day of April, 1884, to which deed and the records thereof reference is made.

"The premises hereinbefore described include and this decree is against those certain lots and parcels of land described as follows:

All that land in the town of Stanford, Dutchess County, and in North Hamilton street, in the City of Poughkeepsie, mentioned and described in a declaration of trust made by George Innis to the Poughkeepsie & Eastern Railroad Company, and dated August 14, 1871, and recorded in the Dutchess County Clerk's office in Liber 176, page 565, of Deeds.

"Also all that land in said City of Poughkeepsie lying south of Oakley Street, which was conveyed to George Innis by the Poughkeepsie, Hartford & Boston Railroad Company by deed dated July 15, 1875, which is recorded in the office of the Dutchess County Clerk, in Liber 181 of Deeds, page 95."

Pursuant to the decree aforesaid all said mortgaged premises will be sold by me in one parcel.

ABRAM J. ROSE, *Referee.*

Dated Dec. 6 1892.
WILKINSON & COSSUM, *Plaintiff's Attorneys*, Poughkeepsie, N. Y.

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The Railroad Gazette:

JANUARY 15, 1886.
MARCH 11, JULY 29, 1887.
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Architecture in Wood—a Protest.
GORDON B. KIMBROUGH.
Building the Cable-Road in New York. Illustrated.
GEORGE ILES.
Industrial Development of the South. III.—TYPES OF RECENT PROGRESS.
R. H. EDMONDS.
Our Remaining Hard-Wood Resources.
CHARLES MOHR.
The Irrigation Problem in the West. Illustrated. H. M. WILSON, M. Am. Soc. C. E.
Labor Troubles and the Tariff.
CHARLES J. HARRAH.
The Gold-Fields of Bendigo, Australia. Illustrated.
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Are American Mechanics Boastful?
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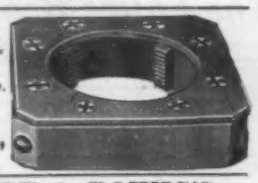

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RAILROAD GAZETTE

FRIDAY, DEC. 30, 1892.

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Contributions.

Tests of Brake Beams.

CHICAGO, Ill., Dec. 22, 1892.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Referring to the table of comparative strength of the National, Westinghouse, Schoen and Central brake beams published in your issue of June 15, 1891, I am unable to understand how the quantities under the heading "Elastic Resilience in Inch-Pounds per Pound of Metal" are obtained. In fact, I do not see how any such results can be deduced from the data given. According to my calculation, they are altogether too high.

GEORGE M. MASHEK.

[We have had several inquiries recently about these results, and have received the following explanation from one of the brake beam companies: "We obtained the elastic resilience by special tests; then from the figures secured, we multiplied the load at the elastic limit by one-half the deflection at that point and divided by the weight of the beam." We have referred the matter to two testing bureaus and hope to get further information for publication soon.—EDITOR RAILROAD GAZETTE.]

Aluminum for Car Roofs.

PITTSBURGH, Pa., Dec. 20, 1892.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Answering your inquiry regarding the adaptability of aluminum for roofs for train sheds and other similar purposes, the metal is peculiarly adapted for this purpose. Aluminum sheet can be furnished with a tensile strength fully equal to that of copper sheet, from 25,000 to 33,000 lbs. per square inch. It can be bent and flanged readily, and can be fastened together in the same way as copper sheets are.

The metal is not acted upon severely by salt water. In this connection, I would state that two plates of about 6 in. square, one of aluminum and one of copper, which have been nailed upon the wooden sides of a schooner that has made a trip from New York to the West Indies and back, were immersed in the sea water together for four months. The sheets weighed 1 lb. 2¼ ozs. avoirdupois for the copper sheet, and 5⅝ ozs. for the aluminum sheet; neither sheet lost any appreciable amount by the service. The original thickness of the sheets was 0.087 in. each, and now is .087 in. and .086 in. for the aluminum and copper respectively, showing that the copper sheet corroded the most under equal treatment. Unfortunately for the advantageous use of aluminum as a sheathing for ships, however, the barnacles seem to thrive on the aluminum sheet, a satisfactory evidence of the relative non corrodibility of the metal, but not of its availability for certain marine purposes.

We have also tested the metal in contact with gases from locomotives, and find that it stands remarkably well, better than copper and far superior to iron. Roofs of aluminum would, due to their light color, add considerably to the light in the buildings as well.

I would not advise soldered joints being used in the roofs, especially with aluminum: 1st, Because of the difficulty with which soldering can be done, although we can regularly and satisfactorily solder the metal. 2d. Because of the considerable expansion which the metal has, soldered joints would soon leak. The same remark applies to copper sheet. The best work done with copper sheet is not soldered, but has the linked joint, such as furnished by Merchant & Co., Philadelphia.

As to the price in large quantities, sufficient to decrease the cost of rolling, the Pittsburgh Reduction Co. stands ready to furnish aluminum sheet of the same thickness at a price which will be equal to what copper sheet for the same purpose would cost. This can be reckoned by taking into consideration the difference in specific gravities of the two metals, copper sheet being 3.6 times heavier than aluminum sheet.

One fact, however, should be carefully considered in this matter, the galvanic action of aluminum with other metals. Aluminum stands very high as an electro-positive metal. When subjected to contact with the electro-negative elements, such as zinc, copper, iron and other metals with which it is likely to come in contact, a voltaic couple is started which is at the expense of the electro-positive metal, the aluminum, and a considerable corrosion would go on; but as the sheet can readily be insulated, so to speak - that is, separated from direct contact with the framework of the roof—this trouble can readily be avoided. Certainly, an aluminum roof for such a train shed as that of the Pennsylvania Railroad at Jersey City would be an advertisement which would be worth considering.

ALFRED E. HUNT.

The Capacity of the Proposed New York Underground Railroad.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In my opinion, speaking as one of say 2,000,000 persons interested in New York's rapid transit problem—you could print nothing more interesting or useful than a discussion of the number of passengers who could be carried on the express trains of the proposed tunnel road. How many people can be carried in such a car. How many cars, according to good practice, can be put in such a train? What is the briefest headway practicable short of suicide or murder? Can you figure out more than 10,000 passengers in say 20 trains an hour? Or call it 20,000 an hour if you wish. Is not that merely a drop in the bucket, measuring by the number of people who want to ride within two hours, morning and evening, or by the number of people the railroad must carry to earn expenses, I do not say interest? I have tried otherwise to inform myself; having failed, I address you knowing no better authority, and believing you would do a great public service if you would discuss the point.

E. A. B.

On the elevated railroads the weight and therefore the length and carrying capacity of the train is limited by the weight of the locomotive which the structure can support. On the underground railroad, where the tracks are on terra firma, no such limit is imposed; and the length of train is, therefore, limited by convenience only, since the gradients have been kept low, much lower than on the elevated railroads. The Rapid Transit Commission proposes that the maximum train shall not be less than eight cars of elevated railroad size. As the elevated trains are composed of five cars, we see at once that the capacity of the underground road with its four tracks would be to the *combined* capacity of the Sixth and Third avenue lines as eight is to five, or 1.6 times as great. As these two lines carry over 76 per cent. of the whole traffic of the elevated railroads it is evident that the underground railroad will have a proportionate capacity of nearly one quarter more than the whole Manhattan system. This is very far from being "a drop in the bucket."

As to the number of people that can be carried per hour, we have the following figures: An elevated railroad car has seating capacity for 48 passengers, with reasonable standing room for 20 more, or 68 per car, making 544 passengers in an eight-car train. On the express tracks a headway of two minutes and on the local tracks one of one and one-half minutes can be maintained. With the fine loop terminals as laid out by the Commission this headway, which is frequently exceeded on the elevated railroads, can be continuously maintained without danger. The hourly capacity in *one* direction only would then be

20 express trains at 544 passengers	16,320
40 local " " "	21,760
Total per hour	38,080

Mr. J. J. R. Croes, M. Am. Soc. C. E., in a recent lecture before the students at the Troy Polytechnic, quoting elevated railroad statistics, showed that 16,200 passengers board elevated trains at all the 11 stations below Chambers street, including City Hall, between the hours of 5 and 6, the time of densest travel. The relief offered by the proposed underground railroad would therefore be extremely great, and not trifling as "E. A. B." fears.

RAPID TRANSIT.

Steam Heating.

The Duluth & Iron Range is said to be the first railroad in the Northwest to heat all its passenger trains by a continuous steam system. The system used by the company is the Searles, and it is said to have proved entirely satisfactory. This road is located in the most northern section of Minnesota.

Passenger Cars on Various Roads.

The difference of opinion which exists on different railroads in regard to the best proportions for passenger cars is well shown by the accompanying table, which contains data relating to the weight and seating capacity of passenger cars on a large number of the prominent railroads in the United States. The table gives the inside length and width of the cars, the weight of the empty cars including the trucks, the seating capacity, the weight per foot of length and per seat, and the square feet of floor space allowed per seat. The dimensions given in the table refer to the present practice for first class passenger cars, and have been obtained from the officers in charge of the car department of the railroads contained in the table. It is probable that all the dimensions given are not exact, and that in many cases the weight of the car is approximate only, but the figures are sufficiently close to give a good idea of the variation in present practice in this class of car construction.

The cars have been divided into four groups, viz.: Cars with four-wheel trucks with and without smoking rooms, and those with six-wheel trucks with and without smoking rooms.

It appears from the first part of the table that the seating capacity of passenger cars varies from 54 to 78, and it will be noticed that the cars having the largest seating capacity are among the lightest cars on the list. The difference in the construction of the cars is indicated by the column giving the weight per foot of length from which it appears that this figure varies from 813 lbs. to 1290 lbs. The dead weight which is hauled per passenger when the cars are fully loaded is indicated by the column headed "weight per seat," from which it appears that this weight varies from 630 lbs. to 1,133 lbs. In other words, it appears from the two columns last mentioned that the heaviest car is about 50 per cent. heavier per foot of length than the lightest, and that the dead weight is in one case nearly twice as much per seat as in the lightest cars. The last-mentioned feature is of course directly affected by the spacing of the seats, and is further illustrated by the last column, which contains the square feet of floor space allowed per seat. This varies from 6.54 to 8.22 square feet. Of course, this is not an exact comparison, as the arrangement of the seats in a car, the space allowed for closets, heaters, etc., varies considerably; but it is an indication of the amount of space which it is considered desirable or necessary to provide for each passenger.

PARTICULARS OF FIRST CLASS PASSENGER CARS.

Cars with Four-Wheel Trucks. No Smoking Room.

Railroad.	Length of car-body inside.	Width of car-body inside.	Weight of car with trucks.	No. of seats. Main part of car.	No. of seats. Smoking room.	Weight per ft. of length.	Weight per seat.	Square ft. per seat.
	Ft. In.	Ft. In	Lbs.			Lbs	Lbs	
Fitchburg	56 7	8 9½	46,000	73	...	813	630	6 81
B. & A.	57 10	8 10	54,500	78	....	944	700	6.54
B. & O.	51 10¾	8 9¼	50,800	60	....	980	876	7.83
C., B. & Q.	52 4	9 0	55,200	60	....	997	887	7.85
B., C. R. & N.	49 3	9 0	50,000	56	....	1,015	893	7.91
Old Colony	59 8	8 9½	61,000	78	....	1,022	782	6.72
St., K. & T.	51 5	8 10	54,000	62	....	1,050	871	7.32
So. Pacific	53 2¾	8 10½	56,300	62	....	1,056	908	7 61
P. & R.	50 8¾	8 7	53,950	62	....	1,064	870	7.02
K. C., F. S. & M.	49 1¾	8 7½	52,800	56	....	1,069	942	7.61
C., C., C. & St. L.	51 4	9 0	55,4 0	64	....	1,079	866	7.22
Illinois Central	50 10	8 10½	54,900	56	....	1,080	980	8.03
L. & N.	49 3	8 9	54,000	60	....	1,096	900	7.18
B. & O.	47 9¾	8 9¼	53,000	56	....	1,109	946	7.48
L. S. & M. S.	51 7½	8 10⅝	58,200	62	....	1,178	939	7.40
C., St. P., M. & O.	51 4	8 10	58,150	60	....	1,133	969	7.55
C. & N. W.	51 2	8 10	58,200	62	....	1,138	939	7.29
N. & W.	45 6¾	8 9¼	53,000	54	....	1,163	981	7.42
Michigan Central	57 9½	8 9½	68,400	68	....	1,183	1,006	7.17
C., R. I. & P.	53 10	9 2	64,500	60	....	1,198	1,075	8 22
Penns. Co.	52 9¼	8 9	65,000	66	....	1,232	98	6.98
No. Pacific	51 0	9 0	64,900	56	....	1,272	1,133	8.20
C. & A.	51 0	9 ⅛	65,800	64	....	1,290	1,028	7.20

Four-Wheel Trucks. Smoking Room.

Mo. Pacific	54	0	9	2	50,000	60	4	926	781	8.24
Can. Pacific	56	2	8	10	58,000	44	12	1,033	1,035	8.86
A., T. & S. F.	50	0	9	0	55,000	56	4	1,100	917	7.50
C. & O.	50	2¾	8	8¾	67,000	64	6	1,138	957	7.34
B. & O.	60	4½	8	10½	73,450	58	10	1,187	1,036	7.74
M., St. P. & S. S. M.	52	10	9	⅛	64,200	44	12	1,215	1,146	8.92

Six-Wheel Trucks. No Smoking Room.

C., St. P. & K. C.	59	2	9	2	76,000	68	...	1,285	1,118	7.97
N. Y. C. & H. R.	59	2	8	8	78,000	76	....	1,319	1,027	6.75
N. Y., L. E. & W.	64	6	8	8¼	86,150	76	....	1,336	1,133	7.36

Six-Wheel Trucks. Smoking Room.

Wabash	62	10	9	2½	75,000	68	6	1,194	1,014	7.82
C. & G. T.	55	3½	9	3½	68,850	53	7	1,245	1,167	8.69
N. Y., L. E. & W.	64	6	8	8¼	86,575	67	7	1,342	1,176	7.55

The last three columns should properly be considered together in order to get a clear idea of the nature of the differences in practice. For instance, the space allowed per passenger by the Pennsylvania Co., is but little greater than that allowed on the Fitchburg, although the latter has the lightest cars per foot of length and per passenger, while the Pennsylvania Co.'s cars are among the heaviest per foot of length. Since this table was pre-

pared the Fitchburg has adopted a design of coach weighing 56,000 lbs., and having 73 seats. The diversity in practice is still further illustrated by other comparisons, as, for instance, the Boston & Albany and the Michigan Central coaches which are of very nearly the same length, but the Boston & Albany coach weighs 13,810 lbs., less than the Michigan Central, and has seats for ten more passengers. In this case the heavier car is not only of a heavier class of construction, but more space is allowed per passenger.

An examination of the particulars concerning cars having four-wheel trucks and smoking rooms, shows a similar variation, although, as would be naturally expected, these cars are heavier than the plain cars, and more space is allowed per passenger. The cars having six-wheel trucks are, of course, heavier than the majority of those having four-wheel trucks, but this does not hold in all cases. In general it appears from the table that the custom of the different roads varies greatly in regard to the amount of space given first-class passengers, and in the weight hauled for each passenger, the square feet of floor space varying all the way from 6.54 on the Boston & Albany to 8.92 on the Minneapolis, St. Paul & Sault Ste. Marie; and that the dead weight per passenger varies from 630 lbs. on the Fitchburgh to 1,170 on the New York, Lake Erie & Western, the latter having also the heaviest coach per foot of length.

We hope at a later date to illustrate some of the cars which appear as extremes in this table, in order that light may be thrown upon the differences in the construction which cause such great differences in weight.

Johnstone Compound Double Bogie Locomotive.

The accompanying engraving represents one of the engines recently built by the Rhode Island Locomotive Works for the Mexican Central Railroad from the designs of Mr. F. W. Johnstone, Supt. of Motive Power of that road.

The engines are of remarkable if not unprecedented power and of very novel design, being intended for work on long 3-per cent. grades (160 ft. per mile) with 18 to 22 degree curves. The special feature of the design of these engines have been on several occasions described and illustrated in these pages* during the present year.

RHODE ISLAND LOCOMOTIVE WORKS.

Specification of a double Bogie compound locomotive engine, having 6 pairs coupled wheels and two 2-wheeled trucks for the Mexican Central Railroad.

Design consists of two duplicate engines bolted together back to back, and having one throttle lever and one reverse lever to operate both ends of engine.

Dimensions.—Cylinders, 13 and 28 in. diameter and 24 in. stroke. Drivers, 48 in. diameter. Gauge, 4 ft. 8½ in. Fuel, bituminous coal. Driving wheel base, 32 ft. 10⅝ in. Total wheel base of engine, 45 ft. 10⅝ in.

Weight.—Total, in working order, about 250,000 lbs.: on drivers about 210,000 lbs., about 20,000 lbs., each truck.

Boiler.—Otis steel shell $\frac{9}{16}$, box ⅝ and ½ in. thick; riveted with $\frac{13}{16}$ and ⅞ in. rivets not over 3 in. from centre to centre; all horizontal seams and junction of waist and firebox double riveted; all longitudinal seams provided with lap welt with rivets alternating on both sides of main seams, to protect calking edges. All plates planed on edges and calked with round pointed calking tools. Tested with 180 lbs. sq. in. steam.

Waist, 54¼ in. diam. smokebox end, made straight, with Belpaire firebox, with one dome 31 in. diam., O. D., placed on waist.

Tubes, Franklinite, No. 13 B. W. G., 201 in each boiler 2 in. outside diam., 15 ft. 9⅛ in. long, with copper ferrules on firebox end.

Firebox, Otis steel, 56 in. long and 56 in. wide; all plates thoroughly annealed after flanging; side and back sheets $\frac{5}{16}$ in.; crown sheet ⅝ in.; flue sheet ½ in. thick.

Water Space, 3½ in. wide; sides, 4 in. back and front; staybolts, ¾ in. diam., screwed and riveted to sheets and not over 4⅛ in. centre to centre; fire door opening formed by flanging and riveting together inner and outer sheets.

Crown supported by through staybolts, 1 in. diam.

Cleaning Holes in corner of firebox, and blow-off cock with convenient handles.

Grates, cast iron, suitable to fuel.

Ash Pan, wrought iron, dampers on sides.

Throttle Valve, balanced, cast iron poppet in vertical arm of dry pipe.

Main Frames, best hammered iron, forged solid.

Front Rails bolted and keyed to main frame, and with front and back lugs forced on for cylinder connections.

Pedestals protected from wear by cast iron gibs and wedges, firmly secured by thimbles and through bolts.

Cylinders, high pressure, simply a sleeve inclosed by the low pressure cylinder, 13 × 28 in. diam., 24 in. stroke, of best close grained iron as hard as can be worked. Each cylinder cast in one piece, with half saddle placed horizontally; right and left hand cylinders reversible and interchangeable; valve face and steam chest seat raised 1 in. above face of cylinder to allow for wear; cylinders oiled by oil valves placed in cab and connected with steam chests by copper pipes running under jacket; pipes proved to 200 lbs. pressure.

Pistons.—Cast iron, fitted with cast iron spring ring packing; piston rods of hammered steel keyed to crossheads, forced and riveted to piston.

Guides.—Cast iron.

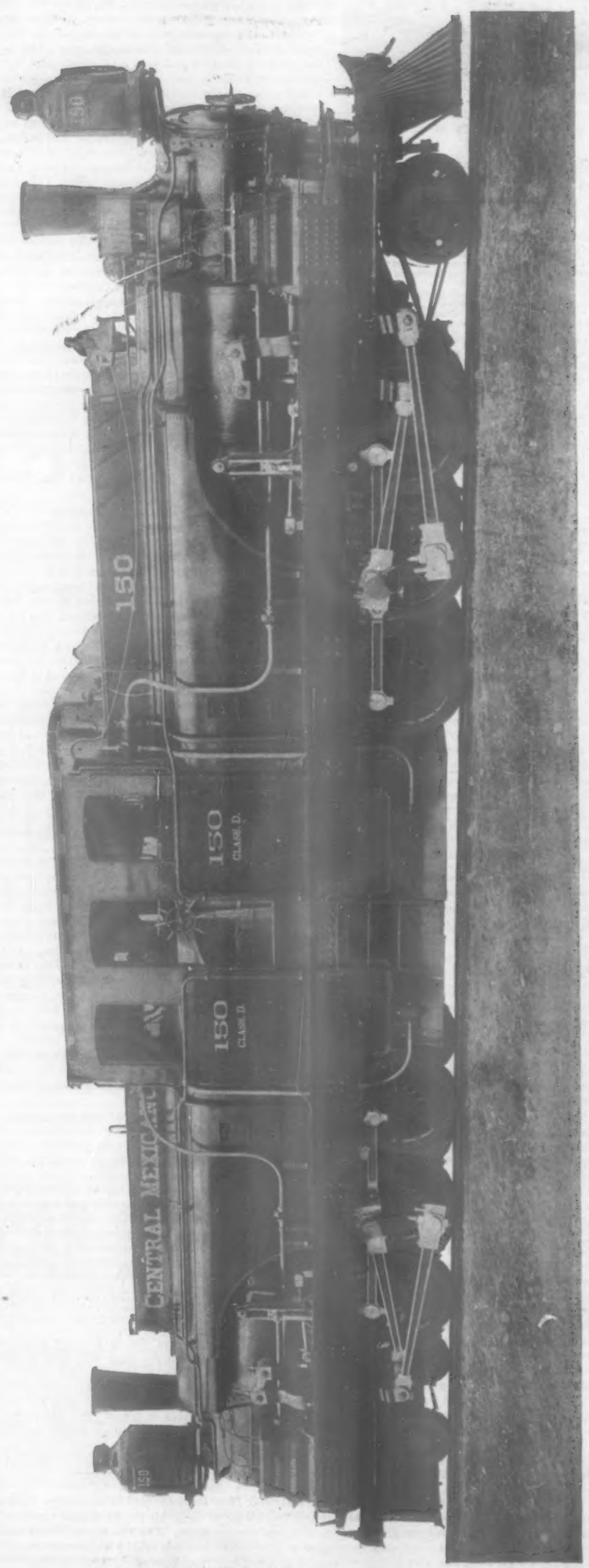
Crossheads.—Cast steel, cast iron gibs babbitted.

Valve Motion.—F. W. Johnstone's design, all working joints provided with removable hardened bushings to facilitate repairs.

Driving Wheels.—Forty-eight inches in diameter; centres of cast iron with hubs and rims cored out and turned to 42 in. diameter to receive tires.

Tires.—Krupp steel 3 in. thick; first and third pairs flanged 5¾ in. wide; second pair plain, 6⅝ in. wide on each engine.

* For general illustrations and description, see pages 222 and 925. The valve gear is described on pages 262, 615 and 633; the result of tests will be found on pages 113, 355 and 633. Indicator cards are given on page 707, and the boiler is shown on page 383, 1892.



JOHNSTONE COMPOUND, DOUBLE-BOGIE LOCOMOTIVE—MEXICAN CENTRAL RAILROAD.
Designed by F. W. Johnstone, Superintendent of Motive Power.
Built by the Rhode Island Locomotive Works, Providence, R. I.

Axles.—Hammered iron; journals 7½ in. diam., 10 in. long; driving boxes of strong close-grained cast iron with wide flanges and heavy brass bearings.

Springs.—Best cast steel, tempered in oil, made by A. French & Co. Equalizing beams wrought iron with steel gibs and keys.

Rods.—Connecting and parallel, hammered iron forged solid, with main rods with universal joints connected to levers operated by crosshead, side rods solid ends.

Crank Pins.—Front and back of Lowmoor iron, return cranks of hammered iron.

Feed Water.—Supplied by Sellers & Friedman injectors.

Engine Trucks.—Two centre bearing swiveling two wheel swing motion trucks with radius bar.

Truck Frame and braces of wrought iron with cast iron cross spider fitted with swinging bolster and wrought iron pedestals.

Truck Wheels.—Two Krupp open hearth steel tires with retaining rings 28 in. in diameter in each truck.

Truck Axles.—Best hammered iron, with inside journals 5 in. diam., 10 in. long.

Truck Springs.—Best cast steel tempered in oil, made by A. French & Co., connected by equalizing beams, resting on tops of boxes.

Cab.—Steel, ⅛ in. thick.

Pilots.—Wood.

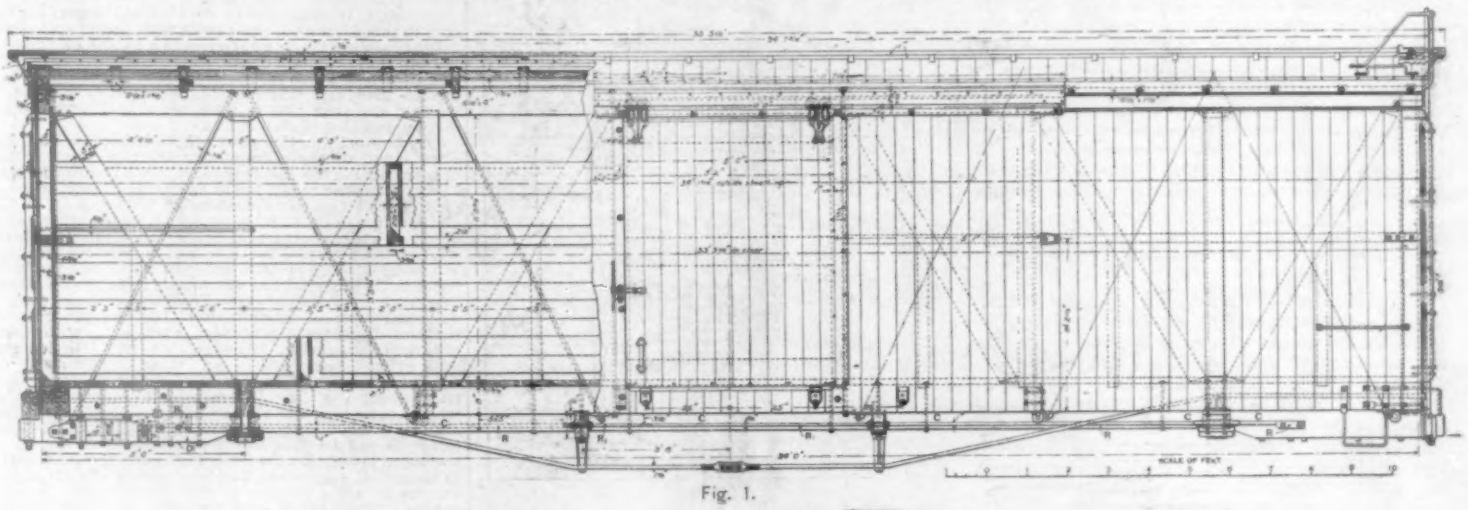


Fig. 1.

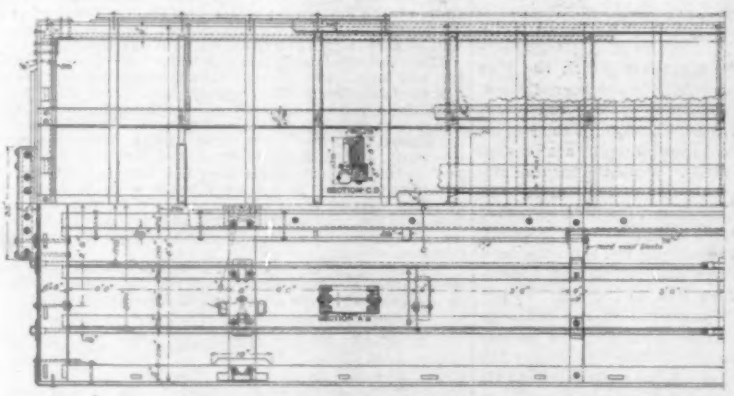


Fig. 2.

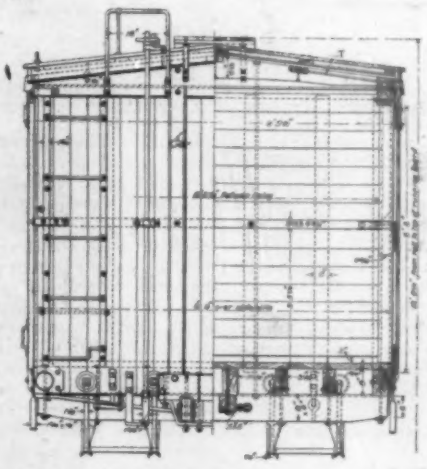


Fig. 3.

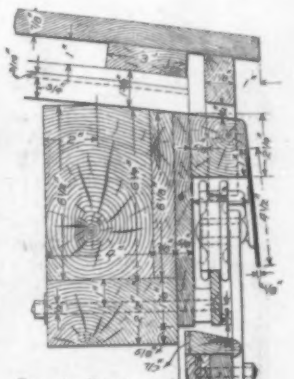


Fig. 4.—Section through centre of door.

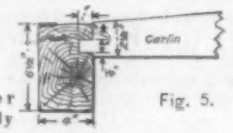


Fig. 5.

STANDARD 34-FT. BOX CAR—LAKE SHORE & MICHIGAN SOUTHERN RAILWAY.

Finish.—Cylinders lagged with wood and neatly cased with No. 12 iron; cylinder head casings of pressed steel; steam chest casings of pressed steel top, sheet iron sides; dome lagged with wood and jacketed with planished iron, and secured by planished iron bands; handrails of iron pipe; running board nosings of tee iron.

Furniture.—Sandbox, brackets and shelf to receive headlamps, bell, whistle, blower and safety valves, heater, steam gauge, cab lamp, gauge cocks, a complete set of tools, two headlights.

Two Nathan double sight feed lubricators.

Driving box linings and connecting rod bearings of Damascus bronze.

All principal parts of engine accurately fitted to gauges and templates and thoroughly interchangeable.

All movable bolts and nuts and all wearing surfaces made of steel or iron, case hardened.

All wearing brasses made of ingot copper alloyed with tin as hard as can be worked.

All threads on bolts cut to United States standard.

Tank strongly put together, well braced with angle iron corners. Bottom and side plates ¼ in. thick; top, ⅜ in.; inside of legs, ⅜ in. Riveted with ⅞ in. rivets, 1¼ in. pitch. Capacity, 3,000 gallons.

Brake.—New York automatic air brake front of all drivers.

One 7 in. duplex pump and one engineer's valve.

Standard Thirty-four-Foot Freight Car—Lake Shore & Michigan Southern.

There is one decidedly novel feature about the freight cars built by the Lake Shore & Michigan Southern Railway, and that is the peculiar draft rigging. It is a continuous draft rigging, both for compression and tension. The compression loads are carried from the draft timbers (D, fig. 1) to the other end of the car in a straight line with the centre of shock, by 5 in. × 5 in. compression timbers (C, fig. 1) extending from the bolster to cross-tie timber and between the cross-tie timbers as shown. One line of these timbers is placed under each centre sill. The continuity of the draft rigging for tension is accomplished by using 1⅛ in. rods (R, fig. 1) securely fastened to each draft timber and carried through the bolster and cross-tie timbers. Rods of the same diameter (R, fig. 1) are passed through the cross-tie timbers making a continuous sectional draft rigging.

The drawbar is provided with a pocket tail strap and two draft springs set side by side. In these cars the various M. C. B. standard appliances and devices are used whenever possible. The end framing is strengthened by using larger timber than is usually specified for freight cars. The whole upper part of the car body is materially strengthened by the use of tie bolts (T, fig. 3) between the purlins and the side plates. The carlins being mortised into the side plates (see fig. 5) and the purlins being let into and bolted to the carlins, the use of tie bolts (T, fig. 3) insures a strong substantial roof and upper car body. The usual tie rods across the car between the side plates are also used.

These cars are 34 ft. 1¼ in. long to outside of sheathing, 33 ft. 3¼ in. in the clear inside, 10 ft. 1¾ in. from bottom of sill to top of running board, 8 ft. 9 in. over side sills, and 8 ft. 2¼ in. wide inside between linings. The rated capacity is 60,000 lbs.

The Financial Status of the Engineer.

Last March the President of the Civil Engineer's Club of Cleveland, Mr. Jas. Leon Gobeille, took as the subject of his annual address before the Club the Financial Status of the Engineer. At a later meeting the subject was taken up for discussion by the Club, and the discussion is published in the October number of the *Journal of the Association of Engineering Societies*, which recently appeared. The address had been published in an earlier issue. We shall try to give, in a short abstract, the gist of the arguments of the various speakers, and shall give first that of Mr. Gobeille.

In his estimation the engineer sees his work, the product of his own brain, perfected by his experience, and accomplished often with great sacrifice upon his part, the means of wealth to other men, while he whose trained intellect and practical research caused the increase is often practically excluded from any adequate share in the financial results. The engineer is not in actual want, but of the wealth of the world directly traceable to the engineer as its producer, a large percentage is constantly going to the business man. The majority of the so-called engineers who have acquired wealth are men of no technical education, but are shrewd men, with elastic consciences. They see the opportunity for a great work of some kind and straightway hire trained men, through whose brains their idea becomes a reality. But these brains are not purchased, but stolen.

The concession that the engineer is not a money-maker necessarily calls for an adequate reason, and it is found in the very nature of his training. The study of mathematics and other precise things which a boy must pursue in order to acquire the technical education of an engineer does not develop the faculties that are called into play by the successful business man in acquiring wealth. A fair statement of fact would be something like this: The engineer, beginning with natural aptitude, developed by years of training, and keeping himself abreast the times only by constant study, research and experiment, is to-day very generally without proprietary business interests, being a man under salary, engaged from year to year. The very nature of his work unfits him for competition in money getting, because he studies *things* while the avowed business man studies *men*. The engineer, therefore, if he desires to become rich, must either abandon his profession or have a better show of success as a beneficiary in the distribution of wealth.

Two courses are suggested. (1) The practice of strict economy during the first 20 years of professional life. An engineer may generally manage to live on half his income, and then when the needs of his family become greater he may have a comparatively large sum invested. (2) Association with a bright, honest young man with an inherited tendency to trade. Take him into equal partnership and he will market the engineer's brains for three times what he himself could secure for them. He will exploit the engineers discoveries and inventions, and will trade in his opinions so as to make the most out of them. The engineer has exceptional opportunites for investment. He is the first man on the ground, and instead of being kept down to a mere salary, as now, he should share the profits with the railroad manipulator and land boomer.

DISCUSSION.

Mr. WM. H. SEARLES: The engineer's fortune is modest (1) Because of the lack of training in commercial values and the art of money getting. (2) Because of his relation to his employer. The engineer does not pursue an independent career, and is regarded only as a necessary expense, so that he does not appear on the profit but the expense side of the account, and therefore his pay is to be kept as low as possible. He is not able to assume the same relation as the lawyer toward his client's interests.

The engineer should familiarize himself with business methods and business men to command confidence, and learn to be a promoter of profitable enterprises. In contracting the engineer has a large field open to him in which men with executive ability ought to make money, but those who follow engineering for the pure love of it will have to expect only a modest income.

Mr. H. F. Dunham: The engineer is simply one of the forces to bring about results which can best be obtained, as is the case with other natural forces, with as little disturbance as possible. Therefore a certain phase of his deficiency would be favorably modified if less praise, notoriety and wealth were considered ample. It is indeed hard in a country like this for the engineer to get his just compensation, but the speaker does not agree as to efforts to be put forth in order to rectify matters.

The engineer should seek to improve his condition by close attention to his own methods, and by making the contrast between well-designed and ill-designed work greater than it is now. But he should not enter trade through the avenue of another man's brains and efforts. It is through such double relations that standards are lowered and the conditions of which complaint is made strengthened. Of course the engineer has the right and privilege to engage in any honorable pursuit, and in many, such as railroad management, and the better class of contracting, his training would be of great value; but while he is doing the work of an engineer he should avoid all relations foreign to that work, and certain to divert his interest from it.

Mr. W. K. Warner: As far as the salaries, fees and wages go, the engineer gets his share. He sells the use of his talent for its market value, and has no reason to expect more. Sometimes a man may get more or less than he is really worth for a little while, but that will soon be readjusted. The engineer is paid for the work he does. When it is the solution of a formula or the computation of the strength of a beam he gets a proper fee, but if he originates and successfully accomplishes great engineering schemes by which Nature's deepest problems are solved, and the commerce of the world increased and civilization advanced, then not only honor but wealth flows to him.

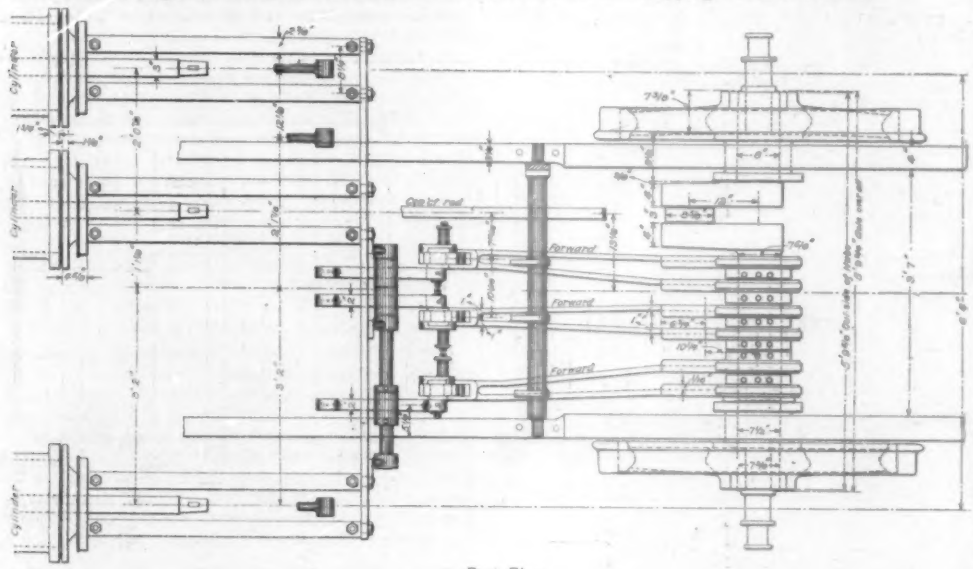
The science of engineering is a very broadening one. The great engineer, like the great general, is a successful leader of men. He leads the capitalist and the promoter of engineering schemes, as well as those armed with pick and shovel. But if he is to do large things his knowledge of mathematics and the sciences must be coupled with keen observation and executive ability.

Mr. Hosea Paul: The engineer who leaves his profession to take up some other pursuit which would be more profitable to him, ceases to be an engineer as long as he remains in it. It may be good advice to tell an engineer to engage in some other business, a contractor rather than a merchant, but this does not settle the question as to the compensation an engineer should receive for his work. The trouble is that the engineering profession itself has been negligent and careless in the matter, accepting what the public has chosen to give, modestly asking little and getting less. Engineers should realize the value of their work to the world, and understand that to them are committed some of the greatest problems of civilization, and that no career is greater or more deserving. They must get their pay as they earn it, independently of the chance or the possibility of securing more in other lines, however obvious or related.

A Three-Cylinder Locomotive.

An interesting departure has been made recently in a locomotive just constructed at the Dunmore Iron & Steel Co's works for the Erie & Wyoming Valley Railroad. This engine is constructed from the designs of Mr. John B. Smith, the General Superintendent of the Pennsylvania Coal Co. in Pennsylvania, and embodies a feature which Mr. Smith had found particularly valuable in the gravity road by which the products of his company's mines were formerly brought to market.

In a long experience as Superintendent of that road he found that the winding engines used at the inclined planes would haul a greater load if built with three cylinders than with two in the ordinary manner. The explanation evidently was that the three cranks, equally divided, gave a more even turning motion on the shaft, and consequently a steadier pull upon the load. These winding engines as usual hauled the load by means of endless wire ropes wound round drums, the power being conveyed from the drum to the rope by the friction or adhesion between them. An uneven turning motion would consequently tend to make the rope slip, and Mr. Smith argues that in a similar manner the use of three cylinders of the same total power as the two now used, will reduce the tendency of the locomotive to slip. Some years ago the gravity road was changed into a steam railroad worked by ordinary locomotives, and after some consideration it was resolved to apply the principle of using the three cylinders working cranks equally divided on a locomotive, the idea being that in starting heavy trains the turning force would be more equally divided and thus slipping would be avoided.



Part Plan.

THREE-CYLINDER LOCOMOTIVE.

Erie & Wyoming Valley Railroad.

The illustrations show the manner in which the idea has been carried out. It was originally considered necessary to use three coupling rods, the coupling rod crank pins being also equally divided, but as built the engine has but two coupling rods and the crank pins are 120 deg. apart instead of 90 deg. as usual. While the turning motion on the main driving axle is undoubtedly more even than with the ordinary arrangement, it will be seen that the strain on the coupling rods and pins varies between wider limits. When one coupling rod is on the dead centre, the other has not yet attained the most favorable position, and therefore has to transmit 15 per cent. greater strain then if arranged in the ordinary manner, with cranks at right angles. This is undoubtedly a disadvantage, but it does not destroy the smoother turning motion given to the main driving axle by the three cranks. It is, however, an open question whether this greater variation of strain on the coupling rod will not offset the gain obtained in the more even turning motion. In the marine engine where the use of three cranks has become almost universal because of the diminished vibration and smaller number of breakdowns owing to the more even motion throughout the revolution, there are no coupling rods to be considered, and therefore it would appear that the use of three equal cylinders with crank pins placed 120 deg. apart would be best suited to a locomotive where coupling rods are abolished. Should any of the much talked of high speed express locomotive be built with a single pair of driving wheels, it would be interesting to try three cylinders. Anything that would tend to give a more even turning motion would be valuable in a high speed engine, as it would tend to reduce the longitudinal or fore and aft vibration now often felt in fast trains, and any device that would tend to reduce the tendency to slip would be valuable in an engine with a single pair of driving wheels, where the amount of adhesion weight is necessarily limited.

The illustrations show the principle as applied to an ordinary passenger engine of American type. The three cylinders are all alike in size. Two of the cylinders occupy the ordinary positions, and the only departure in connection with them is that the pistons work crank pins 120 deg. instead of 90 deg. apart as usual. The third cylinder is placed just inside the frame, and works a crank in the main driving axle. The valves are all placed above the cylinders as usual and are worked by rock shafts, links and eccentrics in the usual manner. One rocker which works the valves of the middle or rather intermediate cylinder is, however, loose on the shaft which runs through it, and merely supports and maintains it in position. The arms working the outer cylinder are keyed to this shaft, and are driven by the middle set of eccentrics. The whole arrangement is very simple and appears to involve the minimum of extra parts. A seperate blast nozzle is provided for each cylinder. It will be seen that the construction introduces no new form of detail except the crank in the main driving axle.

Storage Battery Traction.

Within a few months Messrs. Charles Paine & Sons, of New York, have investigated and reported upon the use of storage batteries for traction, for Mr. J. D. Hawks, General Manager of the Citizens' Railway Co., of Detroit, Mich. Their report has recently been made public, and we give below such extracts as will show the scope of the investigation and the conclusions reached:

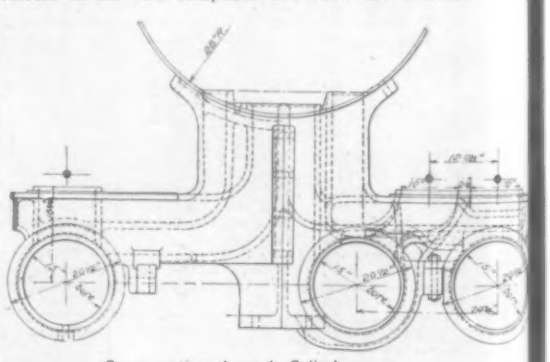
You particularly requested us to investigate the systems of electric accumulators of the Hopedale Electric Co., of Boston, Mass., in use on the street cars of Milford, Mass., and of the Accumulator Co., of Philadelphia, Pa., in use in Washington, D. C. In addition to an examination of these two systems, we have made a study of the general subject, and have consulted several of the engineers who have made this branch of electrical work their specialty.

The only information to be obtained regarding the cost in this country of equipment and operation of street railroads using storage batteries as a means of traction is from those who are directly interested in their sale, and for reasons that are apparent they are quite reluctant to give any information. What they do give is meager, and even that is made questionable by contradiction and absurd statements.

The Accumulator Company, of Philadelphia, Pa., has done much of the accumulator traction work in this country during the last four years, having equipped with its system many roads, but at the present day there is only one of them in operation (at Washington, D. C.), not yet turned over to the owner of the road, but being operated under contract by the Accumulator Company, who declined to state the details of the cost of operation. We were dissuaded from going to Washington, which, without their cordial consent, would have been useless. We have been able to extort from this company only a valueless statement lumping the whole cost of equipment, generating station, cars, etc., with their electrical apparatus, although we had particularly said that we did not want estimates on the generating station nor cars, simply on their electrical apparatus. The Accumulator Company evidently wished to be civil and also to avoid giving away information, except that they now recommended that batteries should be frequently changed—after a run of about ten miles, thereby lessening the weight of battery to be carried somewhat, and prolonging the life of the battery by using it only at the beginning of its discharge. They think such frequent handling, say at every round trip, will be more than compensated by the increased life and efficiency of the battery. They state that when one trailer is drawn, it also must be provided with its own batteries which shall be connected with those on the motor car; when two trailers are needed it is thought that the two carloads of batteries together will be able to pull the third without any batteries.

The Consolidated Storage Co., of New York, has had large experience in the use and manufacture of storage batteries in this country, and more than any, with the possible exception of the Accumulator Company, in their use for traction purposes. Their batteries are almost identical with those of the Accummulator Company, and in their equipment of cars on the Fourth avenue line in New York they use about 3,800 lbs. of batteries per car. In a conversation with their president we learned from him that his company was no longer in the traction field; that they would sell batteries to anyone who wished to purchase them and for any purpose.

We visited the electric road at Milford, Mass., and got what information we could about it. The road is owned by one company, and another is the manufacturer of the system employed upon it, batteries, motors and all. The officers of the two companies are the same men and



Cross-section through Cylinders.

probably the stockholders are also the same. The road has been in operation one or two years (one car now running), yet the superintendent of both road and factory, and the inventor of the whole system, said they were "now trying some new batteries, which, from every indication, would be what they wished to put in the market," but that at present he was unwilling to give any information.

The president of the electric company was equally uncommunicative. We are quite sure, from a glimpse of a battery caught in the office of the superintendent, that it is only a modification of the type of battery already described, and from a published report we learn that on a recent test a car equipped with two 7½-H. P. motors was run by a battery of 136 cells, each weighing 33 lbs. (total weight of battery 4,488 lbs.), 28.82 miles. The car carried a load varying from 7,680 to 9,174 lbs., and on a run of 6,440 ft., in which occur grades of one to two per cent., the car ran at the rate of nine miles per hour.

Considering your specification of requirements, that cars shall make 150 miles per day, running 15 miles per hour and hauling two trailers, we are compelled to estimate the weight of lead battery to be carried at 5,000 pounds per car, which will, perhaps, not be sufficient during snow storms and during icy weather. This dead load is of itself a tremendous handicap upon any scheme

of storage battery traction. It is evident that operating by the storage battery system involves all the expenses of the trolley system, except the small item of maintenance of the trolley and trolley wire, and has, in addition, to bear the cost of transporting, maintaining and handling the batteries. What might be saved in the cost of generating station and overhead construction would, in your case, probably be much more than offset by the cost of batteries.

There are no figures available in this country except what may be taken from the vague statements of those interested in the sale of storage battery apparatus, and none of them who are now in business have had anything like experience enough to know what the cost of operating would be when conducted on a large scale over a long period of time. We do know that the Citizens' Street Railway Co., of Indianapolis, Ind., experimented for about six months with two cars equipped with storage batteries, and returned to the use of mules for two months; after another experiment with the batteries under the care of an agent of the Storage Battery Co. they say: "It was so very expensive and the operating was so unsatisfactory that we finally withdrew them from the road and put up the overhead construction, and are now using the trolley system with great satisfaction." This company estimates that it cost about double to operate the cars with storage batteries that it does with their trolley system.

We have the published report of the Birmingham Co., in England, for 1891-92, which is operating a section of its own road with storage batteries, which

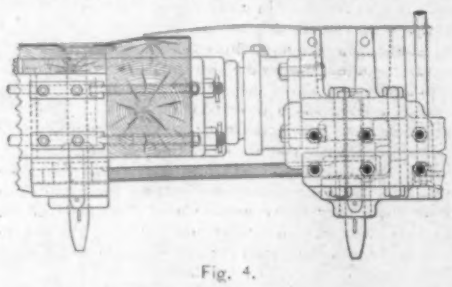


Fig. 4.

contains a comparison of the total cost per car per mile run by several methods of traction, as follows:

	Per car mile.
By storage battery	30.78c.
By horses (teams and busses)	19.92c.
By cable	12.36c.

The returns for the storage cars cover a distance run of 188,700 miles. We are informed that there are 12 storage cars in operation, making an average run for each of 15,730 miles. This comparison confirms the statement made to us by the most experienced manager of storage battery operations in this country, and long at the head of one of the principal storage battery manufacturing companies. He estimates that the total cost of installation and operation of a storage battery road for 10 years would balance the total cost of installation and operation of a cable road for a like time.

We are satisfied that no positive results have been attained anywhere which would justify any company operating horse car lines to substitute storage batteries for the horses. It has not been shown that the storage battery can be depended upon for power under the circumstances which prevail during a Detroit winter, nor can the batteries be conveniently arranged upon the open summer cars. We are, therefore, unable to conceive of any reasons which would lead the Detroit Citizens' Street Railway Co. to make use of the storage batteries for operating any part of its system.

Locomotive and Tender Connection—Pennsylvania Railroad.

Figs. 1, 2, 3 and 4 show a new connection between locomotives and tenders recently adopted by the Pennsylvania Railroad. It appears to be a decided improvement and has for its main object the removal of that disagreeable pounding and knocking which takes place between engines and tenders when the chafing plates are slightly worn, the drawbars somewhat elongated, or the holes in the ends of the drawbars worn.

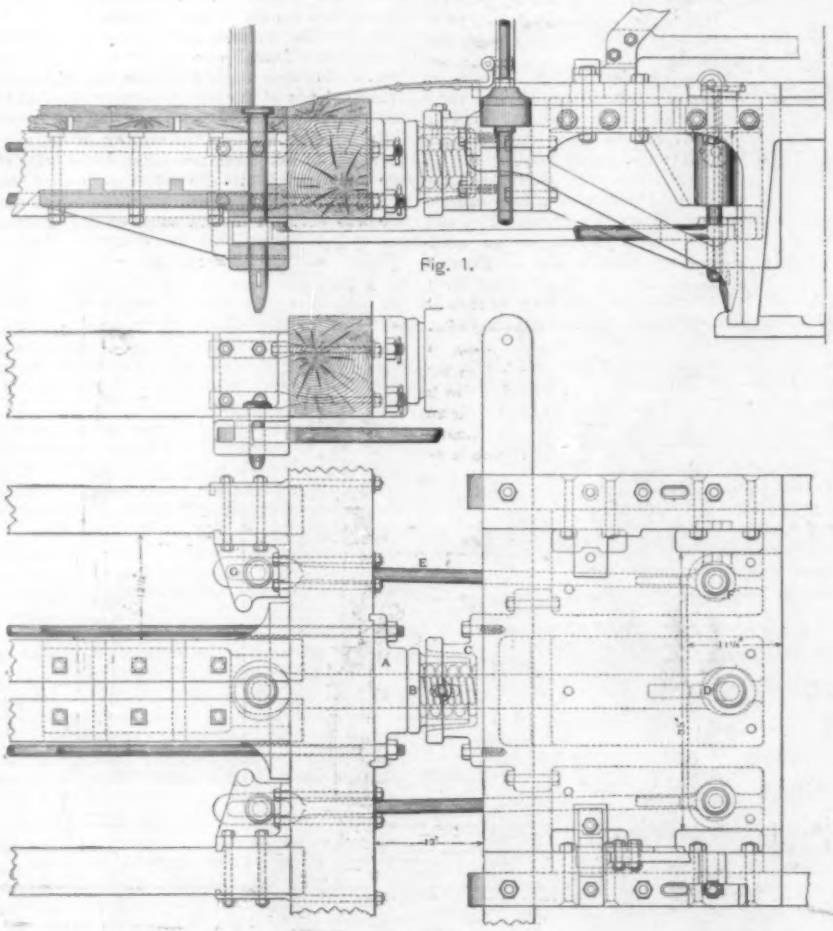


Fig. 1.

Fig. 2.

LOCOMOTIVE AND TENDER CONNECTION—PENNSYLVANIA RAILROAD.

Figs. 1 and 2 show the device as adapted to the class *O* locomotive with 68-in. wheels. There is a chafing plate *A* on the front bumper of the tender which works against another chafing plate *B*, which has a limited movement longitudinally in the draw head *C* on the back bumper of the locomotive. The chafing plate *B* is forced outward by a double coil spring, clearly shown. This spring takes up the slack between the engine and tender and prevents pounding. The spring used in these buffers is what is known as the Pennsylvania class X, and has 19,000 lbs. capacity.

The draw bar is of the ordinary form and is made straight. The hole for the pin in the locomotive end of the draw bar is elongated, as shown at *D*. This is done to permit the longitudinal movement of the draw bar which is necessary for the compression of the spring back of the chafing plate *B*.

An interesting feature of this connection is the safety link *E*. These links are fastened to the locomotive foot plate by a pin at *F*, the tender end of the links being slotted, as shown at *G*, to allow for movement on curves and to permit the compression of the springs back of the chafing plate *B*. These safety links appear to be a decided improvement over a safety chain and have much greater strength for the same weight as the material is used to a better advantage.

Figs. 3 and 4 show the device as adapted for the class "R" engine of the Pennsylvania road. The description which precedes will answer for the description of this arrangement.

The device is applicable to almost any form of locomotive, and those who have ridden much on engines with some slack between the engine and tender will appreciate the value of a connection like this, which furnishes a cushion for the disagreeable shocks that are continually occurring in switching, and frequently at other times, notably, when running on level road with slight changes in grade.

Connections between locomotives and tenders have been neglected in the past for reasons not clear. Attempts have been made to reduce the pounding by the use of taper wedges and chilled chafing plates; but these are not kept up as they are intended to be, and shortly after tightening are loose again. The wedges and chilled chafing plates have one serious defect, which is that they cause an unknown and sometimes dangerous strain on the drawbar. It occurs in this way: The wedges and chafing plates are not generally planed or finished to a true surface, and frequently they have not the conformation that is necessary in order that they may make a true rolling contact; therefore, when the engine passes a curve it frequently happens that by reason of the inaccuracy of the shape of the wedges or chafing plates the distance between the pin holes in the foot plate of the locomotive and the drawhead of the tender is lengthened a little. This compels a stretching of the drawbar and frequently induces a fracture. Thereafter, one of the so-called "mysterious" breakages occurs and we have frequently been shown broken draw bars with a section of about 4 in. × 2 in. of apparently good wrought iron pulled apart while running. The power required to produce such a breakage is vastly greater than any possible strain that can result from the pulling of a locomotive. This causes the breakage to appear mysterious, while in fact it is generally due to the lack of true contour of the faces of the wedges or chafing plates. If an untrue casting is made the connection becomes, when a locomotive is passing a curve, a true knuckle joint press with a great power. From this argument it will be seen that the compressible connection between the engine and tender now used by the Pennsylvania road ought to reduce the fractures in drawbars and be conducive to the comfort of the engineer and fireman.

Peirce's Night Semaphore.

Mr. I. Newton Peirce, of Folcroft, Pa., near Philadelphia, has lately patented a semaphore signal for showing indications at night wholly by position, regardless of the color of the lights, and the device has been shown in operation before officers of the Pennsylvania and Baltimore & Ohio roads who, we understand, speak favorably of it. The essential novelty of this signal is the arrangement for making two lights, situated close together, more distinct from each other, so that they will not run together and present a single image to the eye, as is the case with ordinary bull's eye lamps when viewed from a distance. This is accomplished by means of tubes, as will be seen by the following description sent us by Mr. Peirce:

The arm of the semaphore is about seven feet long, suspended at the centre, at the top of the signal post, on a pivot or pin, upon which it can easily be turned to a vertical, horizontal or diagonal position at will. On this arm are three lanterns, each suspended from two bails or ears, near the top of the lantern so that they will always retain a vertical position, regardless of the movements of the signal arm upon which they hang; one in the centre of the arm and one at each end, the latter being about 3 ft. from the centre one. At this distance apart these three lights would blend or "run together" at a distance of half a mile or more, and appear as one light. To prevent this Mr. Pierce places in front of each lantern a tube about a foot long and about the same diameter as the flange (1½ in.), instead of the convex lens ordinarily used. By this contrivance he cuts off all the diverging rays and sends forward only parallel rays of light. These three lights at the distance of two miles look like three bright stars and indicate clearly the position of the signal. As the observer comes near to the signal, he finds that the

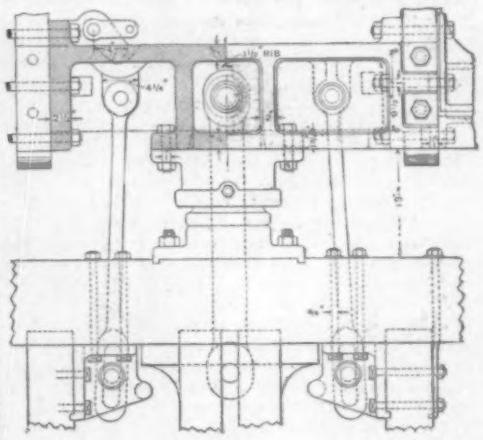


Fig. 3.

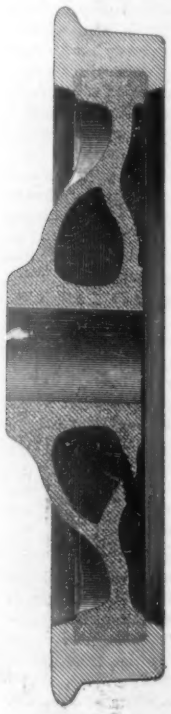
flame, if the lights are on a high post, becomes invisible because the tubes prevent the rays of light from shining downward at the necessary angle; but this is found not to be a practical difficulty, for the inner surface of the tubes reflects enough light to give an accurate indication of the position of the signal. Glass is placed in both ends of the tubes.

The most radical difference between this and the ordinary semaphore is the arrangement of the arm so that the danger signal is in the form of a T instead of an ┐. The lamps being hung from the arm, the daylight signal consists, not of a plain arm, but of an arm with three downward projections. The fulcrum by which the arm is hung to the post is at the top of an inverted V bracket, whose lower ends are screwed to the arm. This brings the centre of gravity low enough so that the arm will assume the horizontal or danger position if a connection breaks.

The Taylor Interlocking Steel Tired Wheel.

The accompanying illustration represents a form of steel tired wheel which has been running for some years, but has hitherto not attracted much attention. As will be seen by the engraving, this wheel has a steel tire and a cast iron centre welded together, the tire having, moreover, undercut rips firmly securing it to the centre. The process of manufacture is as follows:

A steel tire is rolled with two ribs, and being placed in a boring machine, these ribs are roughly undercut. The tire is then heated to a bright red and placed in a wheel mold in which suitable prints are left for the tire. The cope is then lowered and secured, and the wheel poured, when the cast iron centre makes a good weld with the inner surface of the hot tire. The whole wheel is then placed in a soaking or annealing pit and left to cool off gradually.



Steel tired wheels with a cast iron centre welded to the tire have been made for many years, the Sax & Kear and the Washburn wheels being well known; but while cast iron centres and steel tires have been previously welded together, this is claimed to be the first wheel in which the tire has been both welded and interlocked with the centre. The interlocking undoubtedly gives additional security and is a valuable feature.

The undercut ribs on the tire secure it even if the weld should be faulty, but it is claimed that the numerous specimens cut open all show a very satisfactory junction or weld, and that the tire is very firmly secured to the wheel. Some of these wheels have been running on the Central of New Jersey for several years, and, in some cases, until the tire has been worn completely through to the cast iron without showing any sign of failure.

Where care is exercised in the manufacture it would appear probable that a very satisfactory and durable wheel might be made on this plan. The cast iron centre would doubtless contract less in cooling than the steel tire, but as the latter is not so hot at the time of pouring, the contraction of the tire in cooling would probably be nearly equal to that of the centre. A breakage of the tire would seem unlikely to spread to the centre, and unless it did so it would appear impossible for the tire to leave the wheel even if the former were broken into many pieces.

The tire is secured to the wheel with the minimum of work. Many good tire fastenings, such as the Carlton and Strondley, dispense with all bolts or rivets, but all require the tire to be bored and the centre to be turned, while in most, one or more grooves must be made to gauge, and in many fastenings, one or two rings must also be accurately turned. In this wheel no accurate turning is required, and the work need not be made to gauge to be efficient. This method, therefore, would appear to give a very cheap, simple and efficient steel tired wheel. It is manufactured by the Taylor Iron & Steel Co., High Bridge, N. J.

Lattig's Lock for Block Signals.

The National Switch & Signal Co. has recently introduced a "slot" apparatus, the invention of Mr. J. W. Lattig, Electrical Engineer of the company, which is illustrated in the accompanying engravings. It will be seen that the object of the device as arranged in the plans here printed is to throw a semaphore signal to the danger position whenever it is passed by a train, regardless of the action of the signalman. As shown in the drawings, the signal is actuated by the train by means of an electric circuit through the rails, and this rail circuit is shown as extending through the whole length of the block section. Thus there is practically a complete automatic block system to be used as a check upon the block system as operated by the signal men. This is a more elaborate protection than has been put in practice to any extent as yet, but the apparatus can be operated without a track circuit. The signal at station 1 can be controlled by the operator at station 2 by means of a circuit through a wire on poles. There are numerous devices for accomplishing this purpose. One of the first brought out was from its form called a "slot," and that term has come to be applied to all devices having a similar object. Two or three ways of operating this check on signals were shown in the description of the Waterloo interlocking, published in the *Railroad Gazette*, Dec. 16.

Fig. 1*a*, which is an enlarged view of the box fixed on the signal post, shows an electrically controlled signal rod coupler, with the signal rods in their coupled position. Fig. 2*a* is the same, showing the device uncoupled and the parts in the position they will assume as soon as a train passes a signal at safety. Fig. 1 shows a signal with the track connections, the semaphore being in the all-clear position. Fig. 2 shows the same with the semaphore in the danger position, where it has been thrown, without the intervention of the signalman, by the passage of the train. Fig. 1 is assumed to be at the entrance of block section No. 2, and fig. 2 at the outgoing end of that section.

The arrangement of the circuits, magnets and parts is such that whenever and so long as the electrical circuit through magnet *A* is complete the signal rods *B* and *C* are coupled together, and whenever the said circuit is broken they are uncoupled. When these rods are coupled the signals may be operated; when uncoupled the operating lever may be reversed, but the signal cannot be moved.

The details of the coupling device, figs. 1*a* and 2*a*, are as follows: Two signal rods, *B* and *C*, pass vertically through guides in the box *D*. The rod *C* is connected to the operating lever in the tower by connecting rod *F*, and *B* is connected to the signal arm by rod *J*. Rods *B* and *C* are so constructed that *B* slides inside of *C*, the latter being provided with a longitudinal slot, as shown by dotted lines *K*, fig. 1*a*. The slot being the size of the rod *B*, serves as an additional guide to keep both rods in place. Pivoted to rod *C* at point *L* is a lever, *M*, provided with a nose or dog, *N*, which enters the notches *O* of rods *B* and *C*, which notches are side by side, as shown in fig. 1*a*, whenever the signal and its operating lever are in their normal or danger position. Back of lever *M* is another lever, *P*, pivoted to the box *D* at *Q*, and capable of swinging to or from the magnet *A*. Its motion is determined toward the magnet by gravity, and from the magnet by the pressure exerted by the counterweighted end of the signal arm, transmitted by rod *B* and nose *N* on lever *M* to lever *P*.

There are two electrical circuits. The first runs through the track in the usual manner. It operates the relay

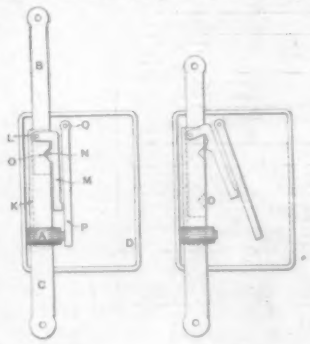


Fig. 1*a*. Fig. 2*a*.

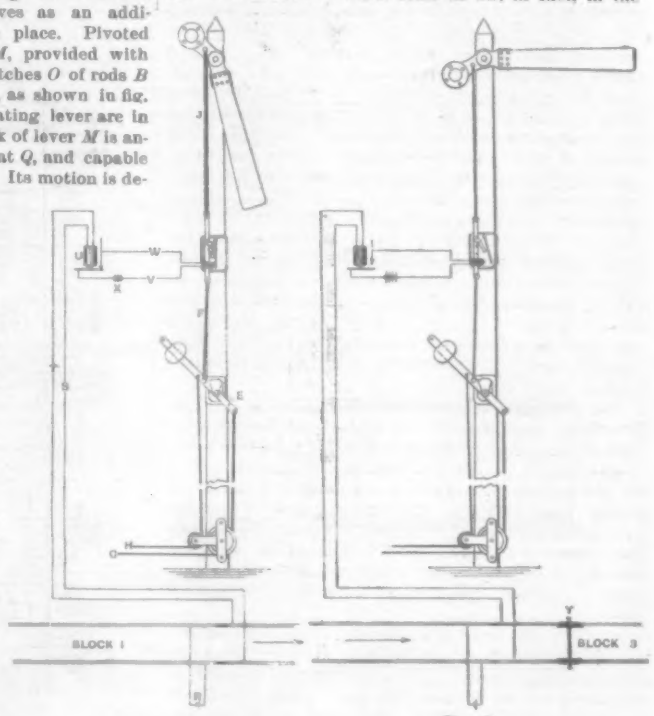


Fig. 1. Fig. 2

Lattig's Lock for Block Signals.

U. This relay controls through its contact points a second circuit, including wires *V* and *W*, battery *X* and magnet *A*. The signals and their operating levers are normally at danger. The traffic is in the direction of the arrows. When a train approaches signal No. 1, the coupler on this signal is in the position shown in fig. 1*a*, and is so locked by the magnet *A*, if there be no trains in block 2. Signal No. 1 can then be thrown to safety, as shown. As soon as the train has entered upon the block the circuit through magnet *A* is broken, and the signal immediately goes to danger by the action of the counterweight on the blade, and cannot again be restored to the safety position until the train and every wheel of it has cleared the block to which it pertains. All the details are arranged to leave the signal at danger in case of failure of any of the parts, batteries, wires, rail circuits, etc.

The arrangement here shown is for double track, with the traffic in one direction only, but by adding an electrical key at each end, with top and bottom contacts, and slightly altering the circuits, the device makes a block signal for single track with traffic both ways. It may be used for this purpose with either a track circuit or an overhead wire, as may be desired.

Cairns to Herberton Railway—Northern Queensland.

BY ALEX. S. MAC TIER, A. M. I. C. E.

The object of the Queensland Government in constructing this stupendous piece of engineering work was to find an outlet from the town and district of Herberton to the sea to convey the tin and various other metals which abound in that locality. Several trial lines were made to reach the sea, chiefly to Port Douglas and Maurilyan Harbor, but Cairns was finally fixed upon as being the port for Herberton, in spite of the opposition of other towns. The engineering difficulties to be overcome were very great, and a period of some four years was occupied in running preliminary surveys before a final and permanent line was staked out, upon which plans and specifications were drawn up and a contract was let to Mr. John Robb, of Melbourne, for some £300,000. It should be mentioned that the first eight miles from the town of Cairns to the foot of the mountain range had previously been constructed, but this being of a very light character does not warrant description. Our remarks will be confined to the second section, some 15¼ miles long, a single line of 3 ft. 6 in. gauge, and formation width 14 ft.

The line, so soon as this section commences, enters on the precipitous range of mountains overlooking the town of Cairns, and severe gradients are at once adopted, 1 in 50 being the general grade throughout the line, and five chains being the ruling radius of the curves. Of course these curves were not strictly adhered to, there being two 4½-chain curves and one 4-chain curve (297 ft. rad. or 19 deg.. and 264 ft. or 22 deg. respectively) over Stoney Creek, an immense chasm stretched over by an elegant iron bridge of 50 ft. and 30 ft. alternate spans, resting on iron trestles.

On breaking ground, the general composition of the cuttings was found to be of soft earth, of a rotten nature, geologically termed micaceous schist, and as the natural slopes of the hills were very steep and the line ran along the sides of these hills, there was great difficulty found in holding the railway in the side of the mountain at all. This necessitated the original centre line being pushed into the hill to get a solid bottom for the formation or road-bed, and in many instances the line was deviated inward some 40 ft.; in fact, in the 15¼ miles, there were 87 deviations from the original centre line, involving a vast amount of most careful and intricate setting out on the part of the engineers engaged. To show the extremely soft nature of the cuttings, the earthworks commenced in March, 1887, had for three parts of the line been excavated to the prescribed batter of ½ to 1 ft., but in January, 1888, the usual rainy season setting in, in a few days the whole cuttings were filled in again, and this occurred many times more, until finally it was found necessary to take the cuttings back to a natural slope varying from 1 to 1 to 2 to 1, and thus increasing the quantities of earthwork as scheduled many times over. The batters of the cuttings thus ran back till the summit of the hills was reached, in some cases a distance of over 700 ft. being the length of the batter of the cutting. The magnitude of some of these slips was very great; in some instances where the slip could actually be measured outside and above the cutting proper, the quantity of muck amounted to over 65,000 cu. yds. The cuttings themselves were enormous, the largest amounting to some 18,000 cu. yds. in 15 chains; in fact, one portion of the line between Camp Oven and Surprise Creek was one long continuous cutting for more than a mile containing many hundreds of thousands of cu. yds., this being caused by the pushing in of the centre line into the hill, the banks for this distance being practically cut out.

Of course in such heavy country, tunnels formed an important part of the work (they numbered 15), and were mostly of a rocky consistency, being, in fact, the projecting spurs of the hills, which consisted of solid bedrock. The setting out of these tunnels required to be most carefully done, they being in several instances on 5-chain reverse curves, where the slightest instrumental error or mistake in figures would involve a loss of many hundreds of pounds to the contractor. The tunnels were lined throughout with 6 to 1 concrete, varying from 15 in. to 21 in. in thickness, as, although of a general rocky nature, soft clay was met with in some strata. Tunnel 15 was found to be very soft, and the timbering required was very strong. This tunnel was excavated from many faces, drives being put in from the side of the hill, and, the centre line of tunnel being reached, headings were again driven right and left on the tunnel alignment.

The culverts formed a not unimportant part of the work. They were all of concrete, no bricks being used at all in their composition. In completing the areas of culverts necessary to carry off a given watershed, a rainfall of 3 in. per hour was allowed for, as in such a tropical climate the rainfall is very great; the experience of three or four wet seasons have shown this allowance to be sufficient.

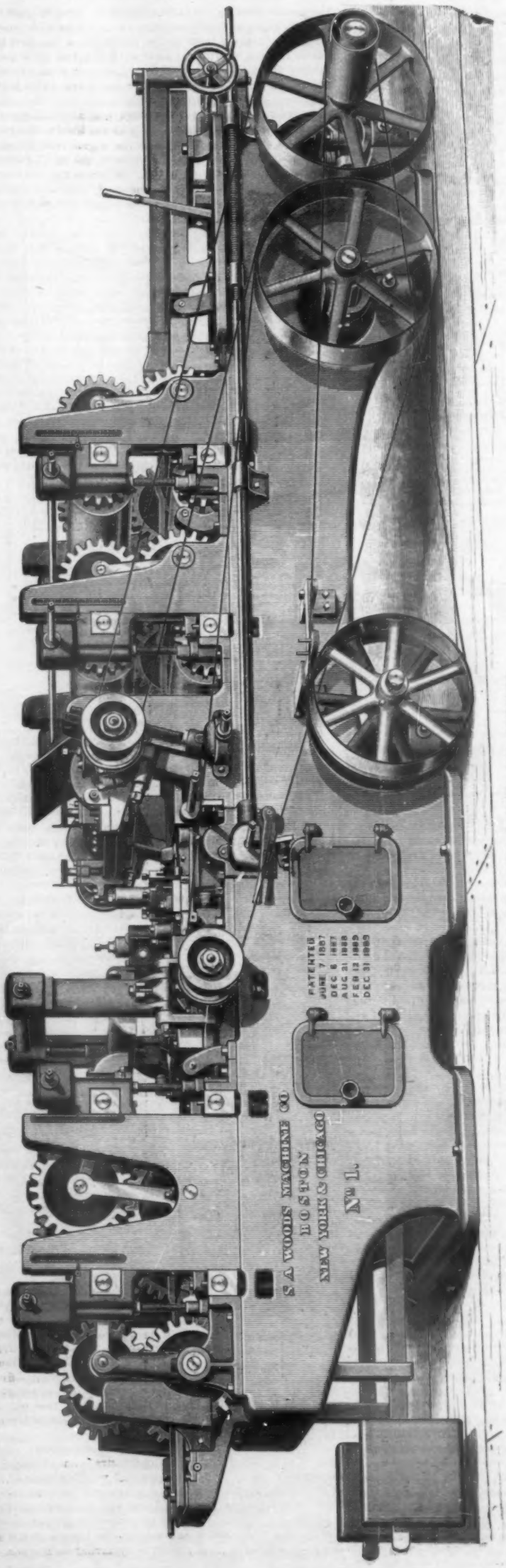
The concrete used in tunnels and bridge piers was Portland cement concrete, the cement being imported in barrels from England and Germany, each shipment being subjected to a prescribed test before being allowed to be used on the works. The stone and sand used were obtained from the bed of the Barron River, the stone being passed through crushers, the jaws of which were given set to the proper dimensions required by the specification.

This brings us to the subject of bridges, which were principally of timber procured in the district, the chief wood being local hickory. As there was no previous experience of hickory on railway work, several experts were appointed to make tests previous to its being adopted by the Government. It should here be mentioned, that in Australia the same wood changes materially in different soils and climates. The timber bridges were of very simple construction, of various spans from 10 to 30 ft., according to the span, the piers being composed of from 3 to 6 piles, the outer piles having a batter of 20 to 1. When greater strength was wanted two rows of piles went to one pier. The heads of these piles were tenoned into a headstock, upon which rested the longitudinal balks on girders to which the sleepers or ties were bolted. The piles were planted in most cases on sills, few being driven. Over the very deep gullies it was found necessary to use iron lattice girders for the central span of lengths of from 75 to 100 ft., the grade being obtained by making one end of the girder deeper than the other. These girders rested on piers of 6 to 1 concrete, the top concrete of each pier being at precisely the same level. On the approaches on either side of the central span the ordinary timber bridge arrangement was adopted.

One remarkable feature of this line was the Red Bluff cutting, where the mountain side becomes very precipitous, and it was found impossible to stake out the centre line of the location through this cutting, and as an alternative traverses were run above and below the centre line, which was then plotted on paper and the curves decided on. The centre line was then pegged out from each mouth of the cutting as the work progressed, but then again, owing to fissures being met with in the sides, the centre line had to be changed repeatedly.

Not the least important feature in this railway was the final measurements. Owing to the very great inequalities of the ground and the batters of the cuttings on the upper side being so very much longer than those on the lower, it was found impossible to obtain even approximate measurement with the tape, and during the progress of the work the contractor was paid at an estimated quantity of 4 cu. yds. per man per day. This was found to be quite insufficient when the final measurements came to be taken, as owing to slips, etc., and the short lead from the cuttings, more than double this quantity was shifted per man per day. Before the cuttings were opened up at all, cross-sections were taken with the theodolite at an average of three cross-sections per chain throughout the entire length of line, the cross-sections being run back at first just beyond the 1 to 1 slopes. It was discovered in the wet season, however, that many of the batters of the cuttings were running back far beyond the 1 to 1 slope, and the centre line being of course obliterated, it was found necessary to run traverses above the cuttings. These traverses were then plotted, and wherever the prolongation of the cross-sections run from the centre line met the traverse a peg was put in. These pegs were then leveled over and cross-sections taken off them to right and to left. The batters of some of the cuttings ran back so far, in some instances over 700 ft., that it was found necessary to run a second and even a third traverse. When the cuttings were taken out, in all cases to a safe batter, the centre line was pegged out on the formation level, and the cross-sections were taken over again on the same lines. Both the surface and final cross-sections were plotted on the same paper, and the area between the two lines of cross-sections was of course the quantity excavated. In taking the final cross-sections great judgment had to be displayed, inasmuch as the irregularities on the batters were very great, and the moving of the position of the staff a few inches in any direction would make a serious difference in the quantities. The price of the contract from the excessive size of the cuttings was increased from £300,000 to nearly £800,000.

Great difficulty was met throughout the contract in the handling of material and in getting it on the works, nearly all the sand and cement for the culverts having to be packed on donkeys, and in many instances rails had to be packed also, involving an enormous expense to the contractor. The line being narrow gauge, the rails used were comparatively light, 40-lb. rails being laid on the straighter sections, and 60-lb. rails where the curves were frequent and sharp. The writer regrets that being guided by memory entirely, in this brief article, he is unable to give more than a cursory description of this really great piece of railway engineering.



A NEW FOUR-SIDE PLANER AND MATCHER.

Made by the S. A. Woods Machine Company, Boston, New York and Chicago.

The Woods Four-Side Planer and Matcher.

The engraving shows a new four-side planer and matcher, recently brought out by the S. A. Woods Machine Co., which the makers think is "as nearly perfect as long experience and careful attention to the requirements of progressive operators will enable them to produce."

The machine is 16½ ft. long and weighs 16,000 lbs., and is sufficiently strong to stand the strain of constant and heavy work. It will plane 24 in. or 30 in. wide, 8 in. or 10 in. thick as ordered. Eight feed-rolls, 9 in. in diameter, driven at both ends by an improved system of expansion gearing, leave nothing to be desired in the way of feed power. The leading-in rolls and corresponding pressure bars are made sectional if desired, and a centre guide can be attached, thus allowing two pieces to be worked at the same time. The under cylinder may be placed at the carrying-out end of the machine, when so ordered. The matcher belts are provided with binders to give additional power to the belts for heavy work. Both side-heads are adjustable across the machine, and the patent geared guide is supplied with this machine when ordered.

The side-heads move on square matcher bars, and may be instantly released for moving, or locked in position by single movement of a lever. The cutter heads are square, slotted on four sides, with bearings 2¼ in. in diameter, running in self-oiling boxes 12 in. long. The chip-breakers are weighted, with adjustable mouth-pieces for light or heavy cut.

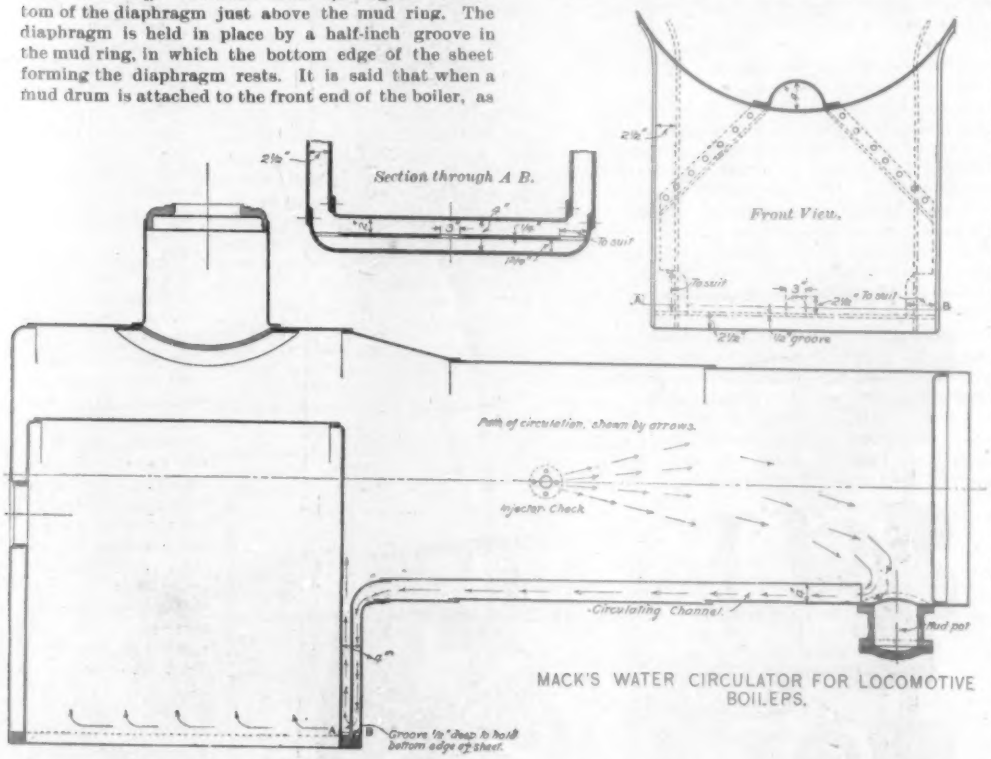
Many patented features of merit are used in this machine, and full particulars may be had by addressing the company at either Boston, New York or Chicago.

Car Heating in France.

Steam heating has been introduced in the trains running between Saintes and Angoulême, France. Steam is taken from the locomotives, and the radiators are in the form of foot-plates for the passengers. The experiment, it is hoped, will be sufficiently satisfactory in its results to bring about the general abadnonment on the several French lines of the hot water cans, which, at their best, are but poor car heaters agents.

Mack's Water Circulator.

A water circulator for locomotive boilers designed by Mr. W. B. Mack, and which has, it is said, given very satisfactory results in practice, is illustrated by the accompanying engravings. It will be seen that the object is to improve the circulation in a boiler by forming a channel along the bottom of the cylindrical part of the boiler and connecting this with a diaphragm in the front water leg, so that a current is maintained as indicated by the arrows in the sectional view. The shape of this diaphragm is shown in the front view and in the section of the water leg. There are three openings at the bottom of the diaphragm just above the mud ring. The diaphragm is held in place by a half-inch groove in the mud ring, in which the bottom edge of the sheet forming the diaphragm rests. It is said that when a mud drum is attached to the front end of the boiler, as shown in the illustration, sediment is carried to it and deposited in it by the current which is kept up by the circulator. This device has been applied to a locomotive boiler on the Boston & Albany Railroad, and we are informed that it is working well.



MACK'S WATER CIRCULATOR FOR LOCOMOTIVE BOILERS.

Horizontal Boring Machine.

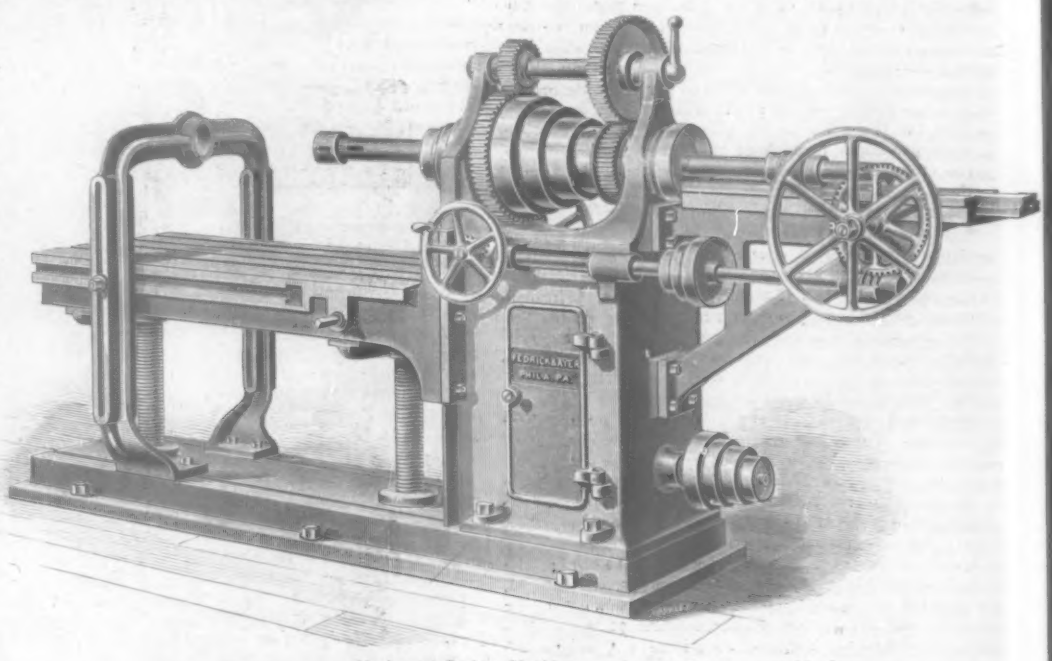
The accompanying engraving represents an improved form of boring machine made recently, brought out by Messrs. Pedrick & Ayer, of Philadelphia. The makers have endeavored to make the machine specially strong and rigid in every part, and at the same time convenient to handle and capable of a wide range of adjustment to suit a great variety of work.

This machine is capable of boring or drilling in the centre of 58 in. in diameter from the main table, and 46 in. in diameter from the supplementary table. The spindle has a traverse of 24 in. to 48 in. as desired, with eight changes of speed and three changes of feed to each change of speed, and a slow or rapid movement by hand operated from either side of machine.

A revolving sleeve surrounding the spindle has a face plate to which a facing head may be attached. The main table is 6 ft. long × 22 in. wide, and is raised and lowered by two geared screws 3½ in. in diameter, and can be raised or adjusted from either side on one end. A supplementary table is furnished that can be placed in any position on the main table, and has a cross movement by screw at right angles to the boring bar. The outer end of the boring bar is supported by an adjustable yoke, which affords great stiffness to bar and table, and can be removed when desired. All "T" slots are arranged to take standard bolts, and are machined out of the solid, not cored.

The following is a summary of the principal dimensions:

Base plate, 5 in. deep, 8 ft. 7½ in. long and 22 in. wide.
Height of spindle from base plate, 47 in.
Face of column 47 in. high, 16 in. wide and 2 "T" slots.
Length of bearing of face of column, 18 in.
Length of table, 6 ft.
Width of table, 22 in.
Diameter of elevating screws, 3½ in.
Vertical movement of table, 29 in.
Travel of feed rack from 2 ft. to 4 ft.
Diameter of movable bar, 2½ in.
Changes of speed, 8 to 24.
Floor space, 13 ft. 7 in. × 32 in. wide.



Horizontal Boring Machine.

Made by MESSRS. PEDRICK & AYER, *Philadelphia.*

Passenger Traffic in Great Cities.*

(*Concluded from page 941.*)

Fallacy of the Continuous Circulation Idea.—It has been a favorite idea with many persons, and particularly of the class who ventilate their opinions in the newspapers over fictitious signatures, that the proper method of operating the rapid transit lines in New York City would be to complete a connection at the upper end between the lines on the extreme sides of the city, and to run trains around continuously up one side and down the other, making loops at the Battery and the Harlem River instead of terminal stations; but a trip down Second or Third avenue and up Sixth, at any time of day would very soon satisfy an intelligent person that such a scheme was entirely impracticable and that the same cars and the same operatives were not at all fitted to handle the different classes of passengers on the two different lines.

Coal Consumption.—Among the variations in operation at different seasons of the year, there may be mentioned one to which I have not before alluded, and that is the different consumption of coal required for operating the roads at different seasons of the year, due to the variations of temperature. Some variation is of course to be expected from the amount required to make steam to heat the cars, but a good deal is undoubtedly due to the difference in radiation from the boilers with differences in outside temperature. I have found on plotting the curve of monthly coal consumption by the same engines doing similar duty during the months in which there was no steam used for heating the cars that the line followed very closely the line of the reciprocal of the average temperature for the same months.

Motive Power.—The question of the motive power to be applied to the city transit of the future is one of great importance. It is still undetermined whether the cost of propelling over a long route a number of trains of vehicles running at varying speed and with varying loads is greater by having the power all generated at a central station and transmitted throughout the length of the line as in a cable or trolley road, or by having each car or train operated by an independent motor. Theoretically, proof can be made to show anyone of the systems to be cheaper than the others. The system of electrical propulsion by the overhead wire and the trolley is conceded by everybody to be a nuisance and less safe than any other system. There seems no reason to think that an underground conductor for the electric current will not some day be devised, and also that a storage battery will not be perfected by which a loaded train can be independently propelled for any distance such as required in city transit. The system of propulsion by a steam locomotive which must carry its crude fuel and water and generate steam as it passes along through the streets of a city is not up to modern requirements, and something else will soon have to be substituted for it.

That a road in the open air will be successfully operated within a very short time by the use of electricity applied in some unobjectionable manner, no one I suppose doubts, but that foul air and deafening noise can be prevented in any system of subterranean travel, I doubt whether anyone really believes.

Fast Long-Distance Service.—No system of rapid transit, as distinguished from quick transit, has yet been put in operation in any city, except for a portion of the day on the Ninth avenue line in New York. It may be worth while to consider the question of the conditions under which such a road can be made remunerative.

From our diagrams of the New York traffic, it seems as if there were only about three hours in the morning and three hours in the afternoon in which any great amount of long distance travel occurs, and it is only during these three hours, morning and afternoon, that there would be as many trains running on the rapid transit route as would be required on the quick transit routes, while during the mid-day and night hours fewer trains might be run. What will have to be considered, therefore, by the projector of any rapid transit route is whether enough passengers are likely to be procured in these hours of the day to pay the expenses of operation and interest on the cost of construction. During the remaining eighteen hours, there is no likelihood that there will be enough long distance passengers carried to pay for the cost of operation. Suppose the road needed to be seven miles long with a station at each mile and that the trains would make 300 round trips. Judging from the reports of the Manhattan Railway Co. for 1891, the cost of maintaining each station is about $6,000 a year and the cost of maintenance of track and structures $15,000 per mile, and the cost of of operation 40 cents per train mile. The general expenses may be put at $100,000 a year. The total cost of operation and maintenance on this basis would be $860,000 annually. To make up this sum would require an average travel of 50,000 passengers a day; in addition, to pay 6 per cent. on each million dollars that the road might cost would require 3,400 passengers per day. By occupying a street, an elevated railway can be constructed and equipped for $450,000 a mile, but in the streets of New York City, particularly in the lower part, there would have to be added to that at least an equal sum for supposed damage to property owners, making the cost of the road not less than $1,000,000 a mile. For seven miles of road there would be required to pay the interest on the cost at this lowest figure, about 24,000 passengers per day, and for every million dollars a mile which the road might cost, a like number of passengerss, 24,000 per day, must be added. The very least number of passengers, therefore, that would warrant the construction of a rapid transit road is 75,000 a day, but 60,000 of these passengers would have to be during the morning and even-

* Extracts from an address by J. James, R. Croes, M. Am. Soc. C. E., M. Inst. C. E., delivered before the students of the Rensselaer Polytechnic Institute.

ing hours of heavy travel. As the Sixth Avenue road alone carries in the hour from 7 to 8 o'clock in the morning about 18,000 passengers and the Third avenue road takes up town in the afternoon in one hour 16,000 passengers, and they could take more if the capacity for carrying them existed, it does not seem unreasonable that a rapid transit road might carry 10,000 passengers an hour during this busy season of six hours daily, and therefore be able to pay its cost of operation and interest on a reasonable cost of construction. If the long distance travel in New York City should increase within the next five years as rapidly as it has in the past, it is not improbable that a rapid transit road would pay for a much greater investment than $1,000 000 a mile. Indeed, considering the growing demand for better accommodation at all hours and in outlaying districts, it is quite likely that such a road might be largely remunerative by being operated as a quick transit road for a large portion of the day over the whole route and at all times in districts beyond those which furnish the most of the long distance travel.

Cost of Construction.—The cost of construction is one of the most serious obstacles to the carrying out of any system of either quick or rapid transit. If the route selected is along a street already devoted to public uses, the abutting owners are entitled to some compensation for their being deprived of the privileges of unobstructed air space to which the original dedication of the street gave them a right. In narrow streets they are further entitled to compensation for the deprivation of light and for the annoyance caused by the emission of smoke and gases from a steam motor. Whether they are entitled to any compensation for noise is an open question. It is difficult to see why they should recover damages from a railroad corporation engaged in filling a public demand and should not get compensation from the owner of a brewery who chooses to drive his wagons along in front of their property for his own sole benefit and to their great annoyance from reverberation and vibration. But a claim for some compensation, the abutting owner on a street diverted from its original purpose unquestionably has, and the amount of the compensation is so uncertain as to be prohibitory to capital, in any case where the immediate returns on the investment are not so clearly very large as to warrant the undertaking of work of uncertain cost.

An underground construction in a street has even greater elements of uncertainty about it. The subterranean rights of abutting owners on a city highway are altogether undeterminate. The question has not come before the courts in any shape at all similar to that which it would assume in case such a mode of construction and operation for a rapid transit road were attempted.

In the case of the construction of a road through property to be acquired for the purpose and not along an existing highway, the cost of purchasing the property would be very great in all the territory through which a rapid transit route is needed at this time; so great indeed that it would be unfair to both those who are to invest their money in the enterprise and to those who are to provide immediate remuneration to the investors for their expenditures, that is to say, the general public to require the burden to be borne by the constructing corporation alone. The capital stock which is to construct and operate the rapid transit road ought to be assured of a fair interest on expenditures, from the outset, and the people who are to have their comfort and convenience provided for, ought not to be compelled to pay more than the minimum rate for the service.

How to harmonize these conflicting interests in the cases of New York and London, where the needed immediate expenditure is so great and the established rate of fare for travel so small, has been puzzling the brains of financiers and law makers for years.

The eminent business men who compose the present Board of Rapid Transit Commissioners in New York have not attempted to promote harmony between the parties who are asked to construct and those who expect to profit by the desired road. The burden is all put on the adventurer. He is required to furnish unlimited capital, do on demand all sorts of previously unspecified and unsuspected acts, collect a minimum fare, and trust to the future for reimbursement of the rest of his expense and his profit. He is given a route on which the least amount of long distance traffic now exists and may be expected in the future to exist, and on which the cost of construction and of damages to property cannot but be the greatest of any in the city. The public, in the meantime, for whom after all this work is to be done, is not called upon to help the enterprise along in any way.

It does seem as if the public, represented by the city government, ought to do something to facilitate the consummation so greatly to be wished. This might be accomplished by the issue of bonds to the amount of the cost of the right of way, whether that is along a public street or through purchased lands. A city of a million and a half inhabitants can borrow all the money it wants at three per cent., and after the road has begun operation, the construction corporation could be required to pay into the city treasury a stipulated sum annually, reserving first out of the gross revenue a sum sufficient to pay for cost of operation, dividend on cost and a sinking fund for the redemption of the debt incurred. But the more we consider the equities of the case, the more evident does it become that the burden of providing a thorough system of intercommunication between the several parts of a great city is one which should be shared by every citizen.

Construction and operation can be more economically and effectively controlled by private enterprise than by public officials who are liable to be changed at any time on grounds of national policy rather than personal fitness.

The right of way is a necessary concomitant of any system and ought to be furnished by the public. The public who use the road must be made to pay a reasonable compensation for the same and this compensation should be made as small as possible.

The private capital which furnishes the means of transportation should be properly remunerated for its outlay, but at the same time compelled to furnish proper accommodation.

If the remuneration to capital is found in the course of time to be greater than is equitable the surplus should be divided among the public either by cash payments or reduction of fares. To ensure harmony and concentration of responsibility there should be only one executive head or corporation managing the entire system of tram transit, quick and rapid in one city, and one department of the city government charged with the duty of keeping that corporation up to the requirements of the public needs.

Reverting to the question of right of way, it seems as if such might be provided without excessive expense in any, even the most thickly occupied parts of a city.

With our modern methods of high building construction a width of 15 ft. would be sufficient for constructing a five-story structure carrying four railway tracks, one above the other, and for those who want to go underground before their final exit from the world, a fifth and even sixth track might be provided below the surface of the ground, and at the street level a tram transit road might run with provision that a stop should be made at every street crossing. Such a system would provide tram transit for a short distance, quick transit for medium and rapid transit for long distances.

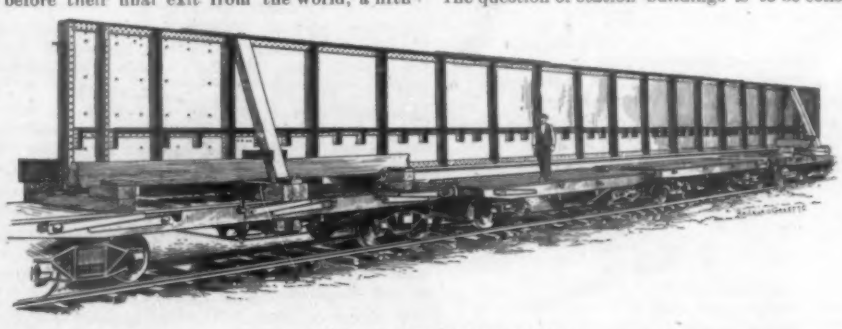
About every third of a mile additional width of about 10 ft. on each side would be needed for station purposes, making the average width taken 20 ft. This would require an area equal to about 32 city lots per mile. With a construction of either masonry or steel and the use of electric motors, the inconvenience to adjacent property would be slight, certainly not as great in residence districts as that caused by a piano or a baby on the other side of a flimsy partition wall.

The Structure.—The beauty of a mechanical structure such as is needed for rapid transit, lies in its simplicity and apparent fitness for its purpose. An appearance of massiveness in masonry and of breadth of surface and fewness of parts in metallic structures, is far preferable to efforts at curved lines misplaced and not in conformity with the nature of the material in the care of metal construction, or terra cotta ornamentation in the case of masonry construction. A simple structure well proportioned is more pleasing to the eye, less costly to keep in repair, and, what is very important, far easier to keep clean and sightly.

Another Long Plate Girder Bridge.

We have recently given some instances of carrying long plate girders by rail. In our issue of Sept. 23 was an account of the transportation for the American Bridge Co. of four plate girders, two of them 120 ft. long each and the other two 119. Those girders were 7 ft. deep. They were transported on 16 platform cars, four under each girder. October 14 we published a letter from the Hamilton Bridge Co., mentioning the shipment by that company of a plate girder drawbridge, the two girders and cross bracing being erected and shipped as one piece. The total length of this bridge was 134 ft. 5½ in.; depth of girders, 8 ft. 5½ in., weight, a little over 69 tons.

The engraving herewith shows the shipment of one of four girders made by the Elmira Bridge Co. These girders are each 123 ft. long, 9½ ft. deep, and weigh 46 tons. They stood on the cars 14 ft. 9 in. above the rail. Seventeen cars were used in the transportation of the bridge in one train. One car carried the lateral bracing, field rivets, etc. This bridge is being erected near Ogdensburgh on the Rome, Watertown & Ogdensburgh from designs by Mr. Katté, Chief Engineer, and Mr. G. H. Thomson, Bridge Engineer of the New York Central system.



Another Long, Plate Girder Bridge.

The contractors were given the alternative of building the bridge of lattice girders or plate girders, but they used plate girders principally on account of the greater ease of erecting. They expect to be able to put one girder in position on the piers in one hour.

Mr. Thomson sums up the general argument in favor of the use of long plate girder bridges somewhat as follows: Railroad men like them. (1). Because of the economy, and this flows from the facts that plates of fair dimensions are now cheap and shop facilities have been improved. Another element of economy is the rapidity and ease of erection. Furthermore, while long plate girders weigh more than truss bridges, the price per pound is cheaper. Modern railroad traffic requires for trusses of 90 to 125 ft. an indefinite amount of extra material to cover contingencies of collision, etc.

(2). Bridges of 100 ft. span and more have been erected at various points on the New York Central in very short times. In one instance that was done with an interval of four hours between trains passing on the old and the new structure.

(3). Plate girders for through bridges are safer in collisions and derailments.

(4). There is no expense of maintenance except paint.

(5). They are not subject to the capricious adjustments of well-disposed but not always well-informed bridge repairers.

Theodore Voorhees on Details of Railroad Operation.*

The title of Mr. Voorhees' address was the comprehensive one of "Transportation," and he opened with a brief account of the engineer's work in locating the road and constructing the roadbed, bridges, etc. He then went on to say:

The question of station buildings is to be considered, what is necessary for the business in view and also what land it may be necessary to secure for terminals and important yards where a large amount of traffic may be expected. Roundhouses have to be constructed. Where land is valuable the most approved form of construction to-day is not a round house at all, but a rectangular house, the engines being put in at an angle of 45 deg. with the base line of the house, and side by side. If you take the trouble to figure that out on paper, you will find it the most economical way possible. Some English engineers who were over here recently said that such a thing as a roundhouse in Great Britain to-day is unknown.

. . . It is important to have an ample supply of sidings if the traffic is to be moved at all successfully. It is not only necessary to have sidings and plenty of double track—four tracks if you will—but it becomes very essential as the traffic increases to have ample yard room at terminal points. It has been our experience on the New York Central, until recently, that we have no difficulty whatever in moving any quantity of traffic that might be offered to us, but we had great difficulty at our terminals for want of yard room to receive our trains for want of tracks to handle them upon.

In regard to wrecking, the practice on different roads varies. It depends very largely on the length of the road. It was our fashion on the D. & H. to call our shop force when we had a wreck. This was in one point of view economical, because the men were experienced mechanics and of good intelligence, and the road would be cleared quickly. Of course it stopped any work in the shop for the day, and in that point of view it was expensive. On larger roads it is the practice to have all wrecking done by the roadmaster and the men under his control, and let the shop men stay in the shops.

The law department has everything to do with taxes, all claims, whether for personal injury or loss or damage to property, everything appertaining to real estate, the right of way and contracts of every nature and form. All these should be properly submitted to the law department and passed upon. I may say here that a railroad man nowadays, to be successful, has to be something of a lawyer himself. The number of questions constantly to be settled off hand, is so great you have not time to refer the disputant to the law department; you must be ready to give an answer on the subject. You have to be posted on the law of the different states where the line runs, and it is of consequence to the engineer to have a knowledge of law and especially the law of contracts.

On signaling, Mr. Voorhees said, among other things: There is hardly any absolute block signal system in use in this country. The absolute block system, as we understand it, is a system that requires the engine driver of a train to come to a full stop when the signal is displayed in front of him and wait there until he gets written [*sic*] orders to proceed. Any other system or signal that is used to block trains should be called the permissive system, because under any other form the engine driver is permitted to proceed after a time interval. . .

Speaking of some troublesome derailments at a certain crossing, Mr. Voorhees said: "We never had a wreck going northbound. It never was a passenger train, but always a freight train. So, studying the thing a little further, I came to the conclusion that the cause of the accidents was this: On the southbound freight trains at that point, just after they passed this crossing, in very

*Extracts from an address before the students of the Rensselaer Polytechnic Institute at Troy, Dec. 7.

many cases, the engineer would have to slack up or almost stop, on account of a drawbridge a little distance south. The slacking of speed on the part of the engineer would cause the train to run together, and if, at that moment, a truck happened to be just over the crossing frogs, it would slew a little and go off the track, the flange going the wrong side of the point of the frog. Going north the freight trains never slacked speed but kept on a steady pull, and they never went off the track.... To obviate this danger movable frogs were put in, and the trouble ceased. I also was interested in knowing from an English engineer who was in this country not long since that they had this precise experience in Great Britain, but did not have a pair of movable frogs on the whole island.

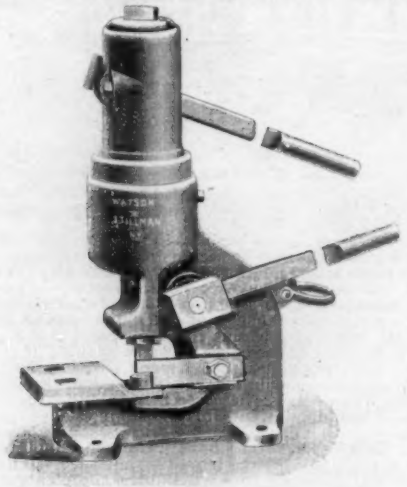
Pressed Steel Brake Shoe Key.

The Drexel Railway Supply Co. are manufacturing a brake shoe key of pressed steel, the form of which is clearly shown in the accompanying illustration. This key is made of steel about ⅜-in thick, is light and strong and should be durable. It will apparently serve every purpose as well as the forged M. C. B. key, with the advantage that it can be readily made of accurate form and dimensions. The business of the Congdon Brake Shoe Co. in the manufacture of the forged M. C. B brake shoe key has been turned over to the Drexel Railway Supply Co.

Hydraulic Punches for Track Work.

Several times during the year we have had occasion to illustrate the handy and well designed, portable hydraulic tools made by Messrs. Watson & Stillman, of New York, for railroad work. Two recent ones which are giving much satisfaction in service are shown herewith.

The first is a hydraulic punch for the spike slot. This tool is an adaptation of the improved hydraulic punch



Slot Punch.

made for the purpose of punching the spike slots in the base of heavy rails for regular railroad service, and is convenient, expeditious and reliable, making a clean cut slot. The body of the punch is somewhat longer than in the regular style of punch, and is cut out in front to bring the centre of the punch to the proper position. As in the improved hydraulic punch, the punch may be brought down to the work without the labor of pumping, being both raised and lowered by the lower lever shown in the illustration. It is carefully designed to avoid the troubles which existed in the punches of this character previous to the introduction of the one brought out by the same company in 1890. The head is of the same construction and size as in the corresponding sizes of the regular make of punch. The No. 2 with 1⅛ in. jaw, weighing about 90 lbs., has sufficient power to punch the 1⅛ in slot in the base of 90 lb. steel rail. Guides are placed on the side for determining the depth, and also to act as strippers.

The second is a hydraulic punch for the web of the rail. This tool can be conveniently used by an ordinary gang of men and does not require to have the rail removed from the roadbed in order to punch it. By the use of the quick-acting lever, shown in the middle of the cut, the ram may be worked in and out a distance of two inches without the loss of time and labor of pumping. In mounting the die in a sliding bolster, which latches it in position, an additional opening is obtained without the extra weight, which would be necessary to get a four-inch movement and also a reservoir of sufficient capacity. A guide is placed at the top of the jaw which once set for any pattern of rail, will cause all holes to be punched at the same height. In returning the punch to the cylinder the pumping socket must be brought down against the head lug before the quick-working lever can be used. Two sizes only are built, as follows: No. 2, for 70-lb. rails, 50 tons pressure, weight 225 lbs.; No. 4, 90-lb. rails, 120 tons pressure, weight 300 lbs.

Train Orders by Telephone.

BY C. A. HAMMOND,
Superintendent of the Boston, Revere Beach & Lynn Railroad.

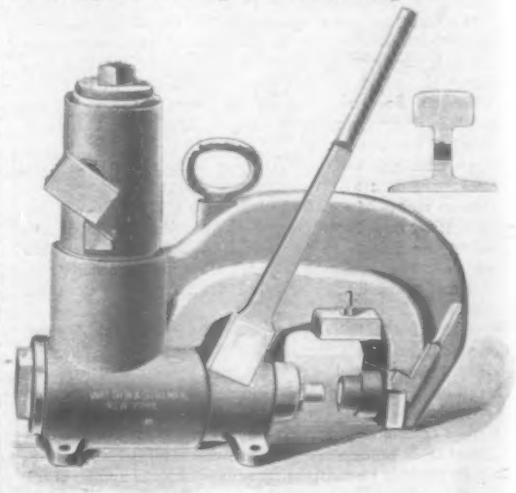
In the last decade of this century of wonders, electricity, as applied to the useful arts, but which many were at first inclined to think a mere *fin de siècle* fad, has advanced with giant strides, until now it has the lightning-like audacity to threaten even a revolution in our methods of railroad practice. The electric telegraph, it is true, has been our capable assistant for many years, and its simplicity in operation and management has very justly been considered to be one of its special claims to favor. Not long after the invention of the telephone and its practical success, it was thought by some that it would speedily become useful in railroad service, and that it might eventually rival if not wholly displace the Morse telegraph in the transmission of railroad messages and train orders. The recent reported action of the Central Railroad of New Jersey in placing the long distance telephone upon its line is likely to bring this subject up for further investigation, and the experiment on that road will be watched with interest.

As a slight contribution in this direction may be mentioned the experience upon the short line of road with which the writer is connected, where the telephone has for a dozen years past been in constant use, successfully meeting all demands made upon it for the transmission of train orders, as well as messages of less importance. It is true that in the early days of the telephone, with the Edison transmitter, and even with the improved Blake transmitter, there were times when the annoyances attending the operation of the line were, to say the least, very trying. These were due chiefly to the use of the ground circuit and the disturbing effects of induction inseparable from it. But notwithstanding these and the drawbacks, due to difficulty in hearing, failure on the part of the hearer to catch the exact sense of the speaker, carelessness or stupidity on the part of the operator at either end, neglect in maintenance, crossing or failure of line wire, induced currents, whereby conversation on one line is heard on another, or sundry electric lighting, electric car, telegraph or other currents, created by induction, causing a multitude of strange noises more or less confusing both to the sender and hearer of the message; notwithstanding these and other troubles—some of them becoming at times highly exasperating and wholly ruinous to the gentle and patient disposition with which every railroad man is blest—the actual results nevertheless have been remarkably satisfactory. The writer has on file some 2,500 train orders in which there is hardly a single error in the transmission of the message as shown by comparison of the copy transmitted with that received, and there has never been any error vitally affecting the construction of the order. That this result has been secured under the somewhat imperfect conditions which formerly obtained in telephone service is believed to be largely due to the system followed and the care taken not to vouch for a message until it has been clearly understood, however difficult it may have been to secure this indispensable factor of safety.

Within the past year or two the entire telephone service of the line above mentioned has been changed to a copper metallic circuit system, using the long-distance transmitter, with sufficient battery power to allow a dozen or more instruments to be placed on a single circuit, the calls for which are readily distinguished by long and short "rings," after the manner of a dot-and dash code. By this system the induced currents are completely neutralized and the line at all times, day and night, is perfectly silent so far as induction disturbances are concerned. The transmission of messages is also performed with the greatest ease and satisfaction. conversation between one station and another being every way as intelligible as that between two persons in adjoining rooms. The sense of distance is entirely obliterated, the conversation between the living speaker and the non-living instrument assuming an intensely personal character, so that the two real speakers are brought closely *en rapport* with each other, and thus is awakened that perfect confidence so necessary in order that the mind of each may recognize the authenticity of the conversation. It is indeed remarkable that such perfect results have been obtained by this means, so that operators, even if unaccustomed to the telephone, readily recognize not only the voice of the speaker, but also those subtle tones by which his very personality and mental attitude are strongly impressed upon the hearer.

The question naturally arises whether, with such a perfect means of carrying on conversation at a distance, the telephone can be safely relied upon to transmit railroad messages and especially train orders, than which none are more important. The writer is of the opinion that, when surrounded by proper safeguards, this may fairly be considered nearly, if not quite, as feasible as by the present method of using the Morse telegraph, since the sense of hearing, whether excited through the earpiece of the telephone or the sounder of the telegraph, is used in each case to convey to the mind the knowledge of the signals or words heard. And here, probably, lies the gist of the whole matter; the telegraph signals may be heard by more than one person and are given at a rate fairly commensurate with the speed of ordinary handwriting, each word being spelled out letter by letter, so that the operator can, as well as not, write down each letter simultaneously with the transmission of the message, and thus words sounding nearly alike but spelled differently cannot be confused. Doubtless a telephone message could be sent in like manner; or at any rate, important words necessary to safety and correct understanding might first be spoken and then spelled letter by letter. In the writer's practice, however, there has been little difficulty of this kind. There are occasional instances where spelling the word makes it perfectly clear to the hearer, and this is always done in case of doubt. As to writing the message, the rule has been for the sender to write his message a few words at a time, either from a written copy or writing it down as he transmits, and requiring the receiver to take down the message on the proper blank, repeating each phrase as uttered; upon the completion of the message or order the whole is read, including number, address, time and signature, whereupon the sender says "O K," which is written on the order and then repeated by the receiver, after which the sender adds "O K" to his copy. No order thus sent is valid unless the letters "O K" appear in the proper place over the agent's signature. Before the order is detached from the agent's book the person to whom it is addressed must sign the stub certifying that he has received order No.—— and fully understands the same. After the order has been fulfilled, it is returned to the Superintendent's office and there compared with his original copy and then filed.

This simple method has worked extremely well; and on occasions when there have been such serious delays as to entirely disarrange the train service, the whole road, including the ferry, has been operated under special telephone orders issued directly by the Superintendent, giving inferior trains rights over superior trains, changing meeting-points, converting sections of the road from double track to single track, running extra trains without notice, providing for relief in case of break down, washout, etc.; in such cases the locomotive of each train wears a "special order" signal while so running.



Bolt-Hole Punch.

Space will scarcely permit a full discussion of the advantages and disadvantages of a telephone service intended to do the work now performed by the ordinary telegraph. It may be said, however, that while technically-skilled operators are not as necessary for handling the telephone as they are in the case of the telegraph, it is a fact nevertheless that a certain amount of "faculty" or gumption is important to secure good results, and it is also true that to successfully handle train orders by telephone would require a well-disciplined force of operators or agents, all of whom should be strictly held to a literal and undeviating compliance with the rules governing the method of taking and repeating orders, down to the minutest detail.

It has been suggested by a telephone expert that the telephone might be used to great advantage in the case of delays, wrecks and other emergencies by having the telephone line wire connected with emergency boxes on every tenth pole or so, each box containing spring jacks, by means of which (by carrying on each passenger train a portable set of instruments and battery) it would be possible for the conductor or any other employé to communicate directly with headquarters, and in this way much precious time and even life might be saved. In this connection it may be stated that the writer has found, in his own experience, that the telephone is a most helpful means of obtaining quickly a bird's eye view, as it were, of the whole situation, this result being greatly facilitated by the rapidity with which the conversation can be carried on; and under conditions of "rapid-transit" suburban train service, where a delay of 10 minutes may disarrange the whole system, the power of rapidly concentrating attention upon the point where assistance is needed has been found to be of great value.

BOSTON, Dec. 27.

Bids for Dredging Gowanus Canal.

Bids for dredging the Gowanus Canal were received by the United States Engineers from the Atlantic Dredging Co., W. H. Beard Co., Morris & Cumings and the International Co. The lowest bid received was from the International Co., at the rate of 13¾ cents for the three channels.

Compound Locomotives in Regular Service.*

October 7, 1891, there was presented to this Society a paper, giving a practical test of compound locomotives in regular service, in which was set forth the results of eleven months' experience on the East Tennessee, Virginia & Georgia Railway, with a number of two-cylinder Schenectady compound locomotives, working against a number of simple engines of like age, build and design, and in similar service. [See *Railroad Gazette*, Nov. 13, 1891.] The belief was stated in that paper that short trials, however accurate, were of much less value than long ones, and that the real everyday work, and that for a time long enough to cover all the vicissitudes of weather, work, fuel, and even men, was, after all, the true test of the engines. The tests considered were believed to be of sufficient length to prove the qualities of the system of compounding used, showing, as they did, that the engines in passenger service, gave an economy of 25.56 per cent. over the sister engines in ten months' work. In like manner the consolidation compounds were shown to have saved 24.70 per cent. of fuel over the simple consolidations in 11 months of like service.

Another year has passed, during which the comparative tests have been continued, and it is of this that this second paper will treat.

Coal Burned.—The comparison of the ten months' work of the passenger engines running between Knoxville and Bristol was shown in the former paper as follows:

	Miles run.	Car miles.	Lbs. coal used.	Lbs. coal per car mile.	Saving.	Per cent.
Two simple engines	107,985	561,935	6,263,654	11.080	.....	.....
One comp'd engine	48,100	254,204	2,097,911	8.252	2.834	25.56

The comparative statement of the work done during the past year is as follows:

	Miles run.	Car miles.	Lbs. coal used.	Lbs. coal per car mile.	Saving.	Per cent.
Two simple engines	144,652	823,618	8,994,000	10.920	.....	.....
One comp'd engine	68,170	373,044	3,081,200	8.260	2,660	24.06

We found that the average weight of the cars hauled by the simple engines was slightly in excess of those hauled by the compound, and have corrected the car miles by adding enough to the simple engines to equalize this difference and make the car miles of the same value (as to weight) in both cases. The error was a small fraction of one per cent. It is quite likely that the figures of last year should have been corrected on the same account, though which way or to what extent is not clear; and as the item is very small it may be neglected. The above figures indicate that the compound has been worked during the past year at almost exactly the same amount of coal per car mile as used during the former year, while there has been an improvement in the simple engines of 1 40 per cent.

If we now combine the statements of the two years we have the following:

	Miles run.	Car miles.	Lbs coal used.	Lbs. coal pr. car. mile.	Saving.	Per cent.
Two simple engines	252,537	1,388,613	15,257,654	10.988	.....	.....
One compound engine	116,270	627,248	5,179,111	8.257	2.731	24.85

or a saving in fuel in two years, every day work, of 24.85 per cent., and that, too, over an engine which is believed to be above the average in economy of fuel. It should be borne in mind that this coal reported is *all the coal* used by the engine during this year, including that used for firing up, banking fires and what might have been left in the firebox after runs.

A little light upon the consumption of coal per car mile may not be amiss. The table below will show the consumption of coal per car mile upon a number of roads in various parts of the country, varying, of course, in grades, quality of coal and character of engines. These figures are taken mostly from published monthly reports of the motive power departments, though some figures were taken from published annual reports of the officials of the roads. They are all official and presumably correct. We are without data as to grades, but have in some cases the average number of cars handled upon freight trains. This may in some degree show the conditions relative to the road over which the engines considered are run, upon which the average train load is 19.8 cars.

COAL USED PER PASSENGER CAR MILE.

(From Published Reports.)

Name of road.	Months.	Lbs. coal per pass. car mile.	Ave. No. frt. cars per train.
C., C., C. & St. L.	5	17.04	20.8
H. & St. Jo.	5	15.80	....
Mo. Pacific	7	17.60	....
N. O. & N. E.	4	21.10	....
N. Y., P. & O.	6	14.12	25 3
N. Y., L. E. & W.	8	19.26	20.3
Wabash	4	13.95	18.1
K. C., St. Jo. & C. B.	5	13.17	....
L. & N.	5	12.85	16.1
Union Pacific	3	16.33	....
C. N. E. & W.	1	21.22	15.4
Chesapeake & Ohio	1	14.76	22.9
Norfolk & Western	2 yrs.	15.00	20.5
E. T. V. & G.	3 yrs.	12.14	19.8
Average		16.12	

Here we have an average of 16.12 lbs., or almost 50 per cent. more than was used during the two years' trial by the simple engine and twice as much as used by the compound.

CONSUMPTION OF COAL PER PASSENGER CAR MILE.

Name of Road.	Pounds.
Chesapeake & Ohio	14.09
Chicago & Alton	13 90
Cincinnati Southern	12.79
C., C., C. & St. Louis	14.05
Louisville & Nashville	11.84
Illinois Central	16 68
Michigan Central	13.22
N. Y., L. E. & W.	17.34
N. Y., P. & O.	13.72
Pennsylvania, East of Pittsburgh	13.64
Pennsylvania, West of Pittsburgh	11.04
Philadelphia & Erie	15.62
Average	13.99

In the *Railroad and Engineering Journal* of December, 1891, we find a statement much of this same kind, tabulated from answers to inquiries from the editor of that paper, and used, tabulated, to show the relative value of English and American engines. The state ments are official and cover a year's or more work, and are unquestionably correct. They are selected as the representatives of American coal consumption. From them we have made calculations of coal used per car mile, as shown in the following table. We find several roads in the list that are in the former table.

He e we have an average of 13.99, or a little over two lbs. less than in the former table. Combining the two we have an average of 15.06 lbs. per car mile. This is 80 per cent. more than was consumed during our two years' work by our compound, and 37 per cent. more than was used by our two simple engines with which the compound was compared. Doubtless some of these roads use coal somewhat inferior to that used in these tests, but, on the other hand, much of the coal used is claimed to be second to none in America; consequently it may be, and probably is superior to that used upon the East Tennessee, Virginia & Georgia. We have not before us, however, any data on that subject.

Just how the grade affected the matter we cannot determine, as our data is imperfect. Very many of the roads mentioned are of lower grades,—very few, if any, have higher grades, though quite a number have probably about the same. At any rate, there is not enough difference in the grades or quality of the coal, or both combined, to account for the difference in the consumption of coal.

It seems a safe conclusion that the simple engines, with which the compounds are compared, are very economical in fuel; hence, the deductions as to economy of compounds are of absolute value.

Various reports of engine tests show better figures than are given in this yearly statement, but it should be borne in mind that they usually do not include the fuel used in firing up or in banking fires, but simply show that actually put in the firebox during the trip. Quite a number of tests were made in this way with East Tennessee engine 254, the result of one set being shown below:

	Feet.	Lbs.
Four trips Knoxville to Bristol, 131 miles up grades in excess	70	6.95
Four trips, Bristol to Knoxville, 131 miles in down grades in excess	70	4.20
One round trip, Knoxville to Chattanooga, 112 miles and return grades	60	5.35
Average of the whole 1,270 miles per car mile.		5.47

[An account of the tests of the Rhode Island compound on the N. Y. P. & B. and the Dean compound on the Old Colony follows:]

During the past year we have had a short test between a two-cylinder and a four-cylinder engine, the latter having two 14 and 24 × 24 cylinders, with 72-in. wheel and a 62-in. boiler, while the two-cylinder compound had 19 and 27 × 24-in. cylinders, with 68-in. wheel and 58-in. boiler, intended to be the equivalent of 19 × 24 in., while the four-cylinder was intended to be the equivalent of 20 × 24, and had a 4-in. larger wheel. In this case the fires in both engines were prepared from coal other than that on tender, and *only coal was considered that was used upon the road.*

The tests consisted of four trips Knoxville to Bristol for each engine, on train No. 2—distance 131 miles, 70 ft. grades, some very long; four trips from Bristol to Knoxville on train No. 1, westbound, same distance and grade, excess of ascent toward Bristol; one round trip Knoxville to Chattanooga (112 miles) and return, trains 1 and 2, grades 60 ft. The coal was accurately measured, as was the water. The four-cylinder engine was run by the man in charge of it for its owners, with such aid as he requested from the company. The East Tennessee engine was run by a man but recently put on it, and certainly he did no better than would a man thoroughly used to it. The total run was 1,270 miles for each engine, on daylight runs, same time, and, so far as could be controlled, under the same conditions.

The results tabulated are as follows:

	2-cylinder Compound.	4-cylinder Compound.	Excess.	Decrease.	Per Cent.
Miles run	1,270	1,270	....	....	....
Car-miles	10,335	10,716	383	....	3.7
Coal used, lbs	56,649	60,850	13,201	....	23.3
Water used, lbs	487,500	540,248	57,230	....	10.7
Water evaporated per lb. coal	8.66	7.73	....	0.93	10.7
Lbs. coal per engine-mile	44.50	54.85	10.35	....	23.3
Lbs. coal per car-mile	5.47	6.52	1.05	....	19.2

The actual car-miles were 10,760, but the average weight of the cars was $\frac{43}{100}$ of 1 per cent. less than the cars drawn by the two-cylinder compound, and in order to equalize this and make the unit equal I have deducted 44 car-miles, this being the same correction made in the year's report. Taking the two-cylinder engine as a basis, the four-cylinder used 9 2 per cent. more coal per car-mile than did the two-cylinder. The four-cylinder engine, as before stated, was the more powerful of the two and did a little over 5 per cent. more work in the whole run. It is to be presumed that she was well handled and made to give as good results as possible. Just before coming to the East Tennessee, the same engine had been tested upon the Norfolk & Western, making, as given in published reports, four round trips from Roanoke to Bristol (151 miles) and return, in passenger service, showing a consumption of 7.5 lbs. coal per car-mile. This was upon the same trains as upon the East Tennessee and over the same character of road and with *Pocahontas coal* the *only coal used on the road*, and of excellent quality. This snowing of 7.5 lbs. was 13 per cent. more than the 6.52 lbs. shown by the same engine upon the East Tennessee. Unfortunately, no simple engine ran upon this Norfolk & Western test.

The effect of the grades is indicated below:

	Coal per Car-mile.		Evaporation of Water per lb. Coal.	
	2-cyl.	4-cyl.	2-cyl.	4-cyl.
4 trips Knoxville to Bristol	6.95	7.56	7.81	7.19
4 trips Bristol to Knoxville	4.20	5.45	10.00	8.26
1 round trip Knoxville to Chattanooga and return	5.35	6.39	8.17	8.02
Averages	5.47	6 52	8.66	7 73

This was in passenger service. On the trips up the grades to Bristol the four cylinder used only 8.5 per cent. more of coal per car-mile, while on the down trip she used about 30 per cent. more. On the trip Knoxville to Chattanooga she used 19 per cent. more, being almost exactly the average of all the trips. The water evaporation per pound of coal was better upon the two-cylinder than upon the four-cylinder, notwithstanding the fact that the latter had a much larger boiler. Just what a year's work would show is a matter of conjecture, though the indications from this test would be in favor of the two-cylinder, from the standpoint of economy in fuel.

[A test of a four-cylinder compound on the C., B. & Q. is then described and a comparison made with the conclusion that the conditions were not very dissimilar.]

We find, however, on the C. B. & Q. ..... 7.53 lbs
" " N. & W. ..... 7.50 "
" " E. T. V. & G. ..... 6.52 "

showing that the amount burned on the East Tennessee was not excessive, notwithstanding the fact that it was 19 per cent. in excess of what the two cylinder compound burned, viz., 5.47 lbs.

Oil.—Another point was tested in the 1,270 miles run, between the two-cylinder and four-cylinder engines, in the way of the use of cylinder oil, and is shown in the following:

	2-cylinder.	4-cylinder.
Pints of cylinder oil used	10	40
Miles run to pint	127	32

Here we find that *on that run* of 1,270 miles the four-cylinder engine used 40 pints of cylinder oil, or four times as much as the two-cylinder engine.

The oil went first into the valve cylinder, which was found to be very well lubricated; thence into the high-pressure cylinder, which was fairly lubricated; thence into the low-pressure cylinder, which seemed to be poorly lubricated notwithstanding the larger amount of oil used. The cylinders of the two cylinder engine were satisfactorily lubricated about as usual. This cylinder oil amounts in one year to about:

2-cylinder	$41.00
4-cylinder	164.00
Saving by the two-cylinder	$123.00

an item certainly worth saving.

No special effort was made by either engineer to economize either cylinder or lubricating oils, both engines using about as usual and what its engineer thought right. No comparisons were made with lubricating oils, no correct account being kept with the four-cylinder engine.

Regarding the compounds in freight service, the two consolidations described in last year's paper have been run during the past year between Knoxville and Chattanooga continually, but no simple engines of the same age and conditions have been run continually against them and no comparison would be fair.

Coal.—The statistics for 11 months' service in former paper were as follows:

Simple.

	Eng. miles.	Car-miles.	Avg. Cars per Train.	Lbs. Coal Consumed.	Lbs. per Car-mile.
4 engs., East End, 6 mos.	81,226	1,355,045	16 67	8,272,533	6.532
4 " West End, 5 "	61,318	1,190,786	19.41	5,977,917	5.029
Totals	142,544	2,525,821	17.23	14,230,450	5.634

Compound.

2 engs., East End, 6 mos.	27,682	495,050	17.88	2,454,142	4.957
2 " West End, 5 "	31,550	717,291	22.57	2,667,505	3.746
Totals	59,233	1,207,341	20.38	5,121,647	4.242
Saving					1.302
Or					24.70 per ct.

The coal per car-mile upon the West End, with lower grades, was in the case of the simple engines 23 per cent. less than upon the East End, while with the compounds it was 24 per cent. less. On the West End the simple engines used:

Per car mile	5.029 lbs.
While the compounds used	3.746 "
Saving	1.283 "
Or	23.52 per cent.

While we have no simple engine service this year with which satisfactory comparison can be made, we can compare the work of this year of the compounds with last, which comparison seem to confirm last year's figures so far as the compounds are concerned.

1892.	Eng. miles.	Car miles.	Av. cars per train.	Pounds coal consumed.	Pounds per car mile.
2 engines 12 months	68,5 7	1,820,513	26.60	6,818,200	3.745

Here we have almost exactly the same consumption of coal per car mile for the year as was shown during the previous year, it

Being	3.745	1892
Against	3.746	1891

Considering that the engines were a year older, and necessarily the machinery is looser in every way, it would seem that they were doing remarkably well to keep even with the previous year in their work.

That we may see the relation of this coal consumption to the general rates over this country, I give below a list of figures compiled, as in the case of the passenger engines, from published official reports of motive power departments and general officers.

Name of Road.	Months.	Lbs. Coal per Car mile.	Average Load.
Alabama Great Southern	4	6.34	15.1
Alabama & Vicksburg	4	6.47	16.7
Cincinnati Southern	4	7.46	14.0
C., C., C. & St. Louis	5	5.97	20.8
Hannibal & St. Jo.	5	6.50	....
Missouri Pacific	7	6 40	....
N. O. & N. E.	4	6.19	....
N. Y. P. & O.	6	7.52	25.3
N. Y., L. E. & W.	8	6.32	20.3
N. S. & P.	3	6 63	....
Wabash	4	6.05	18.1
K. C., St. Jo. & C. B.	5	5.35	....
L. & N.	5	6.87	16.1
Union Pacific	3	8.90	....
C., N. E. & W.	1	7.07	15.4
C. & O.	1	5.76	22.9
N. & W.	2 yrs.	7.50	20.5
E. T. V. & G.	3 "	5.56	19.8
Average		6.60	

(Continued on page 990.)

Train Heating in England.

The Midland Co. are again to the fore in the matter of insuring the comfort of their passengers. Between St. Pancras and Bedford, on two of their principal expresses, and on the trains on the Manchester South District line, the carriages have been fitted with an arrangement for warming the compartments by hot water. Continuous pipes are affixed to each carriage throughout the train which are supplied with hot water from the engine, the result being a great improvement on the time-honored foot-warmer. This carriage warming apparatus is the outcome of much thought, trouble, and expense on the part of the management.—*Railroad News (London).*

*Extracts from a paper by Mr. C. H. Hudson, General Manager of the East Tennessee, Virginia & Georgia, read before the Western Society of Engineers, Dec. 7, 1892.

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

The Master Car Builders' Association committee on attachment of M. C. B. couplers to cars has sent out a letter of inquiry regarding the various kinds of connection between the couplers and car sills. If this inquiry is leading toward a standard draft rigging, or a recommendation for a standard draft rigging, the results must be of great use to all concerned. The types of construction used are endless, and the merit of the different arrangements varies greatly. The personnel of the committee is unusually strong and some useful results is sure to come from their work, and it is hoped that they will be able to see their way clear to make a positive recommendation for the guidance of all. We need to know something more about several important matters. Is a tail bolt the decidedly unsatisfactory connection that it appears to be? Is the tail strap the best practical connection? Are dead blocks of real value with the vertical plane coupler? Is the buffer stop on the vertical plane coupler as essential as it appears to be and how far should it be placed on new cars from the face of the metal plate on the end sill? Does the use of a sub-sill reduce materially the repairs to draft rigging? These are questions that continually come up in the car departments of railroads, and the opinions of the experienced men who make up the committee on this subject will undoubtedly be taken as final statements of fact by the majority of members of the association.

The *Electrical World*, in discussing the recent rear collision at Greenville, N. J., says that an important advantage would be gained by the use of electric power for drawing trains, instead of steam, as in that case an automatic signal system could be made to withdraw the power from the locomotive as it passed the caution signal. It is admitted that devices for shutting off steam have already been applied to locomotives, but it is claimed that the electric engine will have an advantage because the stopping system, instead of requiring a special apparatus on the locomotive, as in the Kinsman system and others of like nature, would be a part of the essential equipment of the line. Our esteemed contemporary should have gone a step further and inquired why these devices on steam locomotives, which are admittedly simple and are comparatively cheap, have not been more generally adopted than they have. The fact is, that there are fundamental weaknesses in this proposition, weaknesses that exist whether the locomotive be steam or electric. One of these is, that a great many heavy and slow trains cannot be run, under the usual conditions now existing, if the power is withdrawn from them at the distant signal. The engineman, although he knows on passing that signal that he must stop at a certain point further on, is often obliged to use steam up to within a very short distance of the home signal. Another case where the theory would fail in practice is on a long descending grade. Withdrawing the power would not stop the train at such a place. It will be answered that the signal apparatus could automatically apply the brakes; but, as was recently pointed out in these columns, it is necessary when using a brake-applying apparatus, to place it under control of the engineman; that is, give him the power to make it inoperative when necessary. To make an automatic apparatus which would apply the brake, and neither stop the train too soon nor let it run too far, is probably beyond the power of even an electrical engineer. And when we admit that some discretion must be given to the engineman, we get back to our starting point.

We have thus far been unable to get hold of a copy of the new South Carolina railroad law, but from an article published in the Carleston *News and Courier*, which contains the protest of the railroads of the state which was presented to the Governor just before he signed the bill, we are able to get a clear idea of the situation. The general business situation in the South is so bad that this case is not complicated by the uncertainties often found in applying state laws to interstate railroads. The simple fact seems to be that the railroad finances are so low that *any* reduction in net earnings, however temporary its character, would be injurious. The protest is signed by the Receiver of the South Carolina and of the Charleston, Cincinnati & Chicago; by the General Superintendent of the Richmond & Danville; by the General Counsel of the Atlantic Coast Line; by the General Superintendent of the Charleston & Savannah, and several others. It begins with the statement that the gross earnings of the railroads of the state this year have been 15 per cent. less than for the last preceding fiscal year, while expenses have remained nearly stationary. This is due chiefly to the very low price of cotton, which, as every one knows, has produced stagnation in general business throughout the South. The result is that not a single railroad in the state is doing more than paying expenses and taxes. Improvements and betterments have all been stopped and nothing is paid on either bonds or stocks. After explaining this point the statement goes on to say that the roads will willingly accept without complaint all the provisions of the law except two: the section which gives Commissioners power to make passenger rates (they already can make freight rates), and that which empowers them to make joint rates (passenger and freight), over two or more roads. It is pointed out that public pressure has always compelled Commissioners to reduce rates, whatever the economic conditions that may affect the situation. This has been almost universally true in every state. The railroad men go further, and say that but for the present unusual depression they would not make even this protest, the substance of their closing appeal beng that they will be willing to accept even this law as soon as reasonable prosperity returns. They are so near insolvency now that they will promise anything to avoid further reduction of revenues. If the bill is as radical as is indicated by the statements heretofore given in the press dispatches it will probably be decided unconstitutional whenever it reaches the courts, for it would clearly conflict with the decision of the United States Supreme Court in the Minnesota case, in March, 1890, holding that railroad rates must be subject to review, as to their reasonableness, by the courts. But the trouble with the South Carolina roads is that even a very short period of low rates would be disastrous to them. They can appeal to the courts, and those whose owners reside in other states will doubtless get their cases into the United States Courts as soon as possible, but even a short delay would work great harm. What the Commissioners will do is not yet known, but the language of the following press dispatch is not reassuring:

"The hayseed-Socialist-Tilman Legislature, under the provisions of the Wilson Railroad Bill, has elected for Railroad Commissioners D. P. Duncan, an ex-Railroad Commissioner of varied politics; H. R. Thomas, a smart but unscrupulous political agitator, and the Rev. J. A. Sligh, a Methodist minister."

Legislation, Discipline and Safety Appliances.

In discussing a disastrous butting collision a few weeks ago, one in which a conductor and an engineman violated the simplest rules, we referred to the necessity of using the block system, and said that legislation compelling its use might be looked for. The superintendent of an important single track road which does not use the block system thereupon sent us a criticism, of which the following is the essential part:

"I note with a feeling of genuine dismay your comments on this collision. I am grateful for many admirable suggestions regarding discipline in the *Railroad Gazette*, but when you suggest that the double order system, which represents the mature conclusions of the ablest experts, drawn from extended experience with traffic of large volume, handled under the most varied conditions, is not worthy of confidence, will you be surprised if we feel that the hand of every man is being turned against us? I have looked into the plans in vogue on single track roads using a system of block signaling, but I am not impressed with their value. I feel that I had rather rely on the double order system. I cannot see that a system of giving block orders from the dispatcher's office lends any great amount of additional security to the movement of the ordinary traffic, not to speak of the work trains and other more intricate variations. Such orders are given on the single order system, and just what the result will be when the men have come to depend upon the single order dispatching part of the system, and have allowed the double order part of the system to fall into desuetude, as I think we may reasonably anticipate that they will, must be left to conjecture." Our correspondent then goes on to remind us that every additional safeguard increases the cost of transportation; the public must either pay for the addition or go without the safety. If the money is spent for safety there must be fewer trains and fewer new railroads, as the public has only so much money to spend. Again, the public will not be satisfied with the very highest degree of precaution if it is not *perfect;* in other words, when a collision occurs under the most perfect block system, the public will demand something better than the block system. " . . . It is true that our American legislatures may go on in the future, as in the past, enacting fool legislation, especially if aided and abetted by technical journals; but I still adhere to the views of the English Royal Commission, which investigated the whole question of safety and the relations of the state to the railroads. The Commission said that government recommendations were all right so long as the railroads were free to accept or reject them; but, as the road must select the men, it should be permitted to choose the appliances for safety which are to be placed in the men's hands. . . ."

While the event that occasioned this letter is now past history, the subject is not out of date, as it involves principles affecting a vital feature of American railroading. It embodies the important question, Is a space interval system necessary to reasonable safety on our more important single track roads? (To bring the discussion within bounds we will confine it to that class of roads.)

In the first place, there is no danger to the duplicate order system of train dispatching from anything that the *Railroad Gazette* may say. We never say anything to discredit the system until it discredits itself by killing people. The imputation that technical journals work harm by encouraging farmers and politicians to attempt the regulation of railroad details by law may or may not be meant for the *Railroad Gazette*, but, it is fair to ask, was not our utterance a reasonable and timely warning to railroad men? Let it be understood that we are not advocating legislative control—far be it from us; but we would call attention to what must be expected. We fully recognize the crudeness of our legislative railroad regulations. We know that even those laws whose main features are just are more than likely to go too far. But we also know that defective and ill-considered laws—at least in the line we are now considering—have generally broken down from their own weakness when the attempt was made to enforce them; so that it cannot be said that the railroads have directly suffered much from this kind of legislation. Practically, if not theoretically, American railroads enjoy about all the freedom advocated by the English Royal Commission. Our Solons are generally innocent enough to leave a weak spot where the railroads can crawl out from under any seriously unjust burden.

And the fact that legislation to enforce the block system may be enacted by any state where agitators "ag'in' the railroads" are active is, we hold, one that railroad officers should bear in mind just now, for two reasons. One is that such a law is quite simple and can be easily discussed without much study or thought. The English law on the subject is very brief. The second reason is that railroads in various parts of the country are adopting the block system more or less completely already. This makes it difficult to argue before a legislative committee that the system is costly or that it is impossible to operate it. Any manager, therefore, who wishes to make any changes in his system of train running and to make them in his own time and way will do well to be prompt in the matter. Although we do not aid or abet mischievous legislation, we think that promptness among railroad managers is sometimes promoted by emphasizing the possibility of legislation, and we therefore emphasize it now. The railroads can introduce the block system in a more rational way if they lay their own plans than if the legislators do it for them, and we want to see rational plans both laid and executed. It would be a great advance if the block system, in a reasonably complete form, were introduced on those

roads whose operating officers already have their plans defined (in their own minds). The passage of a defective law, or even one slightly unjust, might do good by enabling such officers to hasten the execution of their wishes.

Our correspondent speaks of the work of experienced and able experts in devising our present train rules. But he apparently ignores the fact that the rules on whose perfection he would depend are only details of a system. The ultimate argument for the adoption of the block system must rest on the fact that our ordinary system is radically wrong in principle. We recognize the skillful work done on the standard code and appreciate the good results that have flowed from it, but the code has no effect in curing a wrong principle. The conviction is spreading among American railroad managers that anything short of an absolute space interval system is a deficient safeguard against collisions, even on roads of light traffic. We tolerate less complete systems simply because they cost less money and because the loss of life and property has not yet become so great as to be intolerable.

The space interval is safer than the time-interval system, even when the latter is operated by experts and the former by commonplace railroad men; but suppose we assume for a moment that improved discipline would make the time interval satisfactory. We then have to face the fact that orders are forgotten on our best roads, by experienced men, who are reputed to be careful men. With all our improvements in discipline during the past dozen years it is doubtful whether there has been any improvement in this direction. If this is the record in the past what hope have we for the future? Probably the evils of liquor drinking are being lessened more or less slowly; but are we getting men of any better mental quality for enginemen and conductors? Are conductors and enginemen being better trained to check each other against making blunders?

This last element of discipline is alone enough to make one doubt whether further progress is likely to be made. It is one of the hardest features to regulate, because an inspector who would detect negligent habits and advise as to their correction cannot get within sight of his man. But this phase of the matter only suggests the superior facility with which block signal operators can be checked. Where electric locks are lacking, block signal operators do make blunders; but it is not because closer supervision of them is impossible; rather it is because plain and easy methods of testing their behavior are neglected.

Our correspondent's dismay is evidently based to a large extent on his impression that we advocate the English fashion of blocking—short block sections, the best mechanical devices and thorough interlocking of switches with signals. He alludes to the public's habit of demanding impossible perfection, and intimates that our American roads which do some blocking without complete interlocking and other safety appliances are hopelessly wrong. We do advocate for each American road the best system that it can afford; but we need not quarrel about the degree of safety that is desirable. The fear that our imperfect systems may be allowed to degenerate so that their weak spots will become weaker has some basis of reason, and we have heretofore spoken of the necessity of watchfulness at this point, but we are inclined to think that those who operate such systems are quite fully alive to their duty in the premises. The gratification felt by the Wabash, the Chicago, Milwaukee & St. Paul and other roads which have used the space interval on single track for five years or more, having all the operations performed at the ordinary telegraph offices, is strong presumptive evidence that their methods are not without merit. Blocking under the supervision of the dispatchers is not the only system in use. The Baltimore & Ohio instructs its operators to block trains independently of the dispatchers. Other roads employ substantially the same system.

We have little fear that the ignorance of the public is likely to take shape in an ignorant law on this subject. Whenever the railroads are doing the best they can under their existing limitations, they will probably have no difficulty in finding logical and convincing answers for lawmakers or others who demand impossibilities. Even the English law prescribes, practically, only the *appliances* for operating the block system, and the roads are apparently free to work the permissive system just as much as they please. The only check on this is the feeling that any investigation by the Board of Trade which should show that permissive blocking was practiced without reasonable justification would lead to the condemnation of public opinion. Such a check is a healthy one and it would be the only effective check which any law in this country would be likely to put in operation.

The Engineer's Pay.

In the division of the spoils does the engineer get his share? If not, why not? The reader who is interested in these questions will find them discussed on another page; and most of our readers are very much interested, for those who are not engineers stand in much the same relation to the sources of income. They are hired to create or conserve values, to earn or save money, and they are paid by fixed salaries or fees, and have no direct percentage of the profits. For present purposes they are professional men and belong to the census class including "clergymen, lawyers, doctors, chief officers of banks, railroad companies and the like, whose work is mental or administrative." By the Tenth Census this class included only four per cent. of all those people of the United States who are directly "occupied for gain," and it must have embraced authors, editors, artists, teachers, and probably some other small and unclassified groups. This professional class, although so small in numbers—only four per cent. of all the workers—is of mighty importance in society, and has extraordinary means of making itself heard and felt. If it does not get its proper share of the world's plunder there must indeed be something queer in the order of things.

But the Cleveland discussion was about engineers. The main proposition was that they do not get an "adequate share in the financial results" of their work, and the burden of the talk was to develop the reasons why and to indicate the remedy. Without seeking either reason or remedy we are inclined to doubt the correctness of the starting point. On the contrary, as compared with other professional men, is not the engineer well paid in money, not to mention other things? As compared with the man in business does not the professional man get a fair share of the prizes of life? There are lawyers, doctors, authors and artists who make great fortunes and win fame; and so there are engineers. There are others in all these professions who continue to scratch together a bare living; but, from observation alone and without the help of any statistics, we should say that on the average the engineer gets a better living than the members of either of the other professions, and that the percentage of them who get wealth and fame is decidedly greater. There are a good many engineers of sound education and very respectable abilities working for $2,000 a year, and for even less. But look around you and see how many lawyers and doctors there are who make less than that. In fact, in engineering, as in every other profession and in all walks of life, the mass of men must be hewers of wood and drawers of water for the gifted few. The great fees are not paid for mere technical acquirements, but for judgment. Some rare men develop this highest quality of the mind young, and with what to most men seems to be very little experience. In more men it ripens slowly as the fruit of knowledge. In most of us it never reaches such perfection as to bring a very high price in the market. Mr. Gobeille says that an engineer may generally manage to live on half his income, and the inference from his context is that the engineer can do this the first 20 years of his professional life. Possibly, but generally he does not, and how many men in other professions do or can? On the whole, the engineer has better chances to make money than other professional men, and we do not believe that he is duller or slower to take advantage of them.

But, as compared with men who go into trade or manufacture, or promotion, or any branch of what, for brevity, we may call business, the professional man does have less chance to lay up a competency, and far less chance to make a great fortune. He also has less chance to make a great failure. It may be some comfort to him to know that 90 per cent. of all those who try to do business on their own account fail.* So, perhaps, the men who work quietly on for a moderate income, while other men take the business risks, come out as well in the end, even if their success is measured by money alone. And here comes in an economic principle. The man who takes the risk of investing the money is the man who ought to have the chances of large gains, and he must have them or he will not venture his money. Of course we are all familiar with cases of men who make fortunes by promoting or financing projects who risk no money of their own; but even they are examples of the working of the same principle. They make money because they can command capital, and whether it is their own or that of other men is not to the point. One reason why men go into professions rather than into business, probably the greatest reason, is that they have not the necessary money capital to go into business; therefore they have no right to expect such great gains as they could expect if they risked their accumulated cash.

But after all it is a mistake to measure the engineer's success or his rewards by money. He probably makes as much money as other professional men, he probably gets on the average as many of the comforts that money can command as the business man gets, although he has less chance to make a great fortune; but he gets, to a greater degree than most men, those prizes of life that money cannot buy. He has social distinction. In this country he takes rank with the members of other learned professions, and, grade for grade, no one has more consideration. Even in England engineering has become almost a learned profession, and it is now admitted that an engineer may be a gentleman. He has a singularly fortunate education. He learns not only mathematics and precise facts as to the relations of things, as some of the Cleveland gentlemen assumed in trying to account for his alleged failure as a money maker; but the cases that come up in his own practice and the study of the great deeds of other men develop contrivance, mature the judgment and strengthen the imagination. His work is stimulating and his interests are often as broad as the continent. He is not pressed to fool his clients or to do violence by sophistries to his own intelligence and conscience. Back of all this is the everlasting satisfaction of being in a profession all the traditions of which teach fidelity in trust and scrupulous honor in all things. In such a profession a man may be influential and respected and happy, if he does not get rich.

*"There has long been a substantial agreement among those competent to form an opinion that 90 per cent. of all the men who try to do business on their own account fail of success. Investigations in Worcester (Mass.) showed that of every 100 men in business in that place in 1846, 67 were out of business in 15 years, and most of these disappearances were failures. Out of 75 manufacturers in 1850 only 30 died or retired with property: and only six of the sons of the 75 now have any property or died leaving any.—*D. A. Wells; "Recent Economic Changes."*

A Contemporary's Criticism of Locomotive Tests.

One of our contemporaries objects to the report of tests of simple and compound locomotives made by Mr. Wm. O'Herin, Superintendent of Motive Power of the Missouri, Kansas & Texas (See the *Railroad Gazette*, Nov. 11), in an editorial in which some statements are made that should not go unnoticed.

It is said that "In looking at a report of this kind one of two impressions must be made, either that the report is absolutely worthless for the purpose of giving information concerning the comparative efficiency of the two types, or that it shows the compound to be the superior. It is needless to explain to anybody who takes the time and pains to investigate these matters that the former is the proper conclusion, but there are many master mechanics who make changes and improvements on the basis of results obtained by other persons and on other roads. A statement that a compound locomotive on a certain road proved 36 per cent. more economical than a single expansion while working on the same track and in the same service would be taken as positive information, and treated as such, and if any action were taken in the matter compound locomotives would be purchased with the expectation of obtaining results 36 per cent. better than those obtained by the use of single expansion engines. If, however, the single expansion engines were anywhere near what they should be, these results could not be obtained, and the compound locomotive would be condemned."

As we understand our contemporary, the gist of his argument is: First, that the report referred to is absolutely worthless because the compound engine was heavier than the simple engine and carried higher pressure steam; Second, that many master mechanics will make changes or recommend them on the bare statement that a compound locomotive appeared to be very much more economical in a certain case without taking the trouble to investigate the circumstances under which the test was made; and Third, that these results could not be obtained if the single expansion engine were well proportioned for its work, and that consequently the compound locomotive would be condemned.

We fail to see how any such conclusions can be drawn from the report referred to, and we certainly do not believe that any sane master mechanic is going to buy compound locomotives on a bare statement of an exceptionally large saving without carefully investigating all the circumstances under which this saving was effected. Nor do we see why the compound locomotive should be condemned because the saving in a certain test was less than 36 per cent. As a matter of fact no more conservative body of men exists than American master mechanics. If anything, they err in being too conservative.

Now the facts of the tests which we reported are that the compound locomotive carried a steam pressure 30 lbs. higher than the simple engine. The weight on the drivers was 5.8 per cent. greater, and the total weight of engine and tender was 3.8 per cent. greater than the simple engine. Further, the weight of train hauled by the compound was 9.8 per cent. more, and the saving, as shown by the whole test on the ton basis was 28.7 per cent. of coal. Greater steam pressure is of course a considerable factor in favor of the compound, but it is by no means proved that the efficiency of the simple engine can be increased 15 or 20 per cent. by increasing its boiler pressure 30 lbs. as our contemporary seems to believe. The

compound has a somewhat greater weight on its driving wheels, and should, therefore, haul heavier loads, which it did in the present test. As its total weight is also greater, there is that much additional weight to be accelerated and hauled over the road. The steam distribution in the simple engine could undoubtedly be improved. These differences do not show that the report is absolutely worthless for the purpose of giving information concerning the efficiency of the two types, and it certainly does show that the compound was superior in this particular case. Just how much allowance is to be made for the difference in the two engines is a matter which no one can determine exactly.

But if 28 per cent. saving in coal can be obtained by substituting compound for simple locomotives, as in this case, and the compound has cost nothing for repairs, while all simple engines built at the same time have had repairs made, why should Mr. O'Herin spend time and money in trying to make his simple engines beat his compound? If any other master mechanic can possibly effect a similar saving by any combination of compounding, higher pressure and heavier locomotives, it is his duty to try for it, and that is the practical conclusion to be drawn from these tests.

It will be remembered that a speed of 97.3 miles an an hour for a single mile was recorded on the Central of New Jersey a few weeks ago, and an account of the trip published in the *Railroad Gazette*. The best previous record was 91.3 miles an hour, by the same engine, which was a record taken during the process of making some indicator cards, but not for any specified distance. Lately it has been stated in print in one or two places that a speed of 98.4 miles an hour had been made on the Reading road, and on inquiry we find that the General Manager of the Reading has a record of 4.1 miles traversed in 2¼ minutes, equal to 36.5 seconds a mile, by one of the regular Blue Line express trains consisting of an engine and four cars. This was between Skillmans and Belle Meade, N. J., on July 20, 1890. It is not stated what engine made this speed, but it was presumably one of the Philadelphia & Reading type of fast (simple) engines such as No. 206. The other records above 90 miles an hour recently made have been by the Vauclain compounds. The way in which these reports are published indicates that possibly their sponsors do not feel the most complete confidence in their accuracy. The 98-mile record would have been more likely to be challenged in 1890 than now, as even 90 miles an hour was then questioned by a good many men quite familiar with fast running. Even the 97-mile record of Nov. 18 last lacks the positiveness which one likes to see in matters of this kind. It is alleged that the man who took the time was not provided with a stop watch. This 98.4 rate seems to have been computed from station to station (not from mile posts), and the time is not given in minutes and seconds but reads "2¼ minutes." In such very fine divisions of time there, is, of course, a large chance for error. The New York *Sun* recently sent two reporters to Philadelphia, who were to tell the readers of that paper about the experience of riding at 100 miles an hour, more or less, as it felt to them; but the rails were a little slippery that day and 90 miles an hour was the best time made. This was with engine No. 618, a Vauclain compound, with Wootten firebox, which was described in the *Railroad Gazette* of Nov. 13, 1891, and July 1, 1892. This engine has one pair of leading and one pair of trailing wheels, each 4 ft. in diameter, and the main connecting rod is attached to the third drivers. We print these scraps of information for what they are worth. As we remarked in discussing the "record-breaking" runs of September, 1891*, engines on numerous railroads have doubtless made better speed than has been recorded of them. As all runners who make good time like to have it known, even though they failed to have the run timed, this leads to many uncertain statements. The one thing certain in the present matter is that the New York and Philadelphia line of the Philadelpia & Reading and the Central of New Jersey continues to show the best records in the world for short distances.

The Pacific Mail Steamship Company has secured a permanent injunction against the Panama Railroad, restraining the latter from establishing a line of ships to compete with the Pacific Mail, and from doing anything else to impair the value of the existing contract between the two companies. The present differences arose, it will be remembered, in consequence of the falling off in freight between New York and San Francisco, or rather in the profits on this business. The Pacific Mail has for a long time received a subsidy from the transcontinental railroads, and therefore was secure in a good income, however light the freight movement, but this subsidy is now, or soon will be, withdrawn. It seems that a portion of it went to the railroad, and the movement to establish another line of steamers is apparently an effort of the railroad to work up new business to take the place of that which has been lost. It appears that the chief ground on which the steamship line secured the injunction was that the proposed new line would interfere with business from Panama to Acapulco and other Central American ports. On this business the Pacific Mail made a definite contract in 1872, when it purchased the steamship lines which the Panama road had established, by which the road not only delivered over the business but also guaranteed its good will. The great amount of discussion which has been printed in the newspapers concerning the international issues connected with this dispute seems to have been mostly got up for political purposes, or, worse still, to produce alleged political issues for the purpose of affecting the stock market.

In a recent interview, Surgeon-General Wyman, of the Marine Hospital, Washington, is reported to have said that there are two facts which make the situation with regard to cholera still serious. One is the appearance of fresh cases of the disease in Hamburg, and the other its continuance in Russia. He urges the speedy passage of a bill which will enable adequate national action to be taken. Eminent physicians, whose opinions have been asked by the Joint Committee of the two Houses of Congress, agree that the danger is still such as to demand great precautions and as to cause much apprehension. Dr. Bryant, Medical Commissioner of the Health Board of New York, looks for a visitation of cholera next spring and summer. Dr. Cyrus Edson, Sanitary Superintendent of New York, thinks that we must expect a severe epidemic next spring if the reports from northern Europe are true. The other physicians who have written to the Committee express the same views with more or less positiveness, and a committee of distinguished doctors, who made a special report to the New York Chamber of Commerce, held the same opinion. We take the liberty of again calling the attention of the railroads to all of this, as we have tried to do several times before.

Mr. W. M. Acworth, who has written much on high speeds, is endeavoring to convince the London *Engineer* that it is an advantage to have locomotives that can pull an extra car. His ultimate success seems extremely doubtful.

NEW PUBLICATIONS.

The Construction of Pump Details. By Philip R. Björling. New York: Spon & Chamberlain, 12 Cortlandt street. 1892. 278 illustrations, 208 pages.

This useful little work supplements the "Practical Handbook on Pump Construction," by the same author, and goes very thoroughly into the various details of suction pipes, check valves, pump rods and other connections, which, when badly made or designed, are a great source of annoyance. It is, therefore, important that the proper construction of these details should be thoroughly understood and carefully considered, and the work under review will certainly be of great assistance in this respect. The book is very clearly and concisely written, and is not encumbered with any mathematical formulæ or long tables and is well illustrated.

Track Laid in 1892.

The record of railroad construction in 1892, shows that there has been a little over 4,000 miles of new track laid in the United States in that period, or about the same amount of new mileage as was built in 1891. The Pacific Extension of the Great Northern is to be credited with 588 miles of this total, and the track laid on that line in Washington, 351 miles, brings that state to the head of the list of states laying new track. Other long lines built this year are the Sandusky & Columbus Short Line, in Ohio; the Texas extension of the Chicago, Rock Island & Pacific, in the Indian Territory, and the Wyoming extension of the Chicago, Burlington & Quincy. The Pennsylvania Railroad has built nearly 120 miles of new road. Following is the table of new mileage by states:

Alabama	24	New Hampshire	13
Arizona	19	New Jersey	12
Arkansas	20	New Mexico	6
California	82	New York	260
Colorado	15	North Carolina	63
Florida	121	North Dakota	92
Georgia	40	Ohio	209
Idaho	83	Oklahoma	11
Illinois	78	Oregon	15
Indiana	136	Pennsylvania	275
Ind. Ter	102	South Carolina	35
Iowa	55	South Dakota	6
Kansas	1	Tennessee	78
Kentucky	23	Texas	232
Louisiana	73	Utah	29
Maine	15	Virginia	30
Maryland	31	Washington	467
Massachusetts	21	West Virginia	201
Michigan	224	Wisconsin	20
Minnesota	189	Wyoming	102
Missouri	238		
Montana	126	Total U. S.	4,015
Nebraska	76		

Compound Locomotives in Regular Service.

(*Continued from page 987.*)

As in the case with the passenger figures, we will introduce a statement prepared from figures from the December, 1891, *Engineering Journal*, showing the consumption of coal per freight car mile on the leading American roads, as before stated, selected to compare with English consumption:

Roads.	Lbs. per car mile.
Chesapeake & Ohio	6.74
Chicago & Alton	4.73
Cincinnati Southern	4.30
C., C., C. & St. L.	4.99
Illinois Central	7.06
Louisville & Nashville	7.11
Michigan Central	4.90
N. Y., L. E. & W.	6.61
N. Y., P. & O.	5.17
Pennsylvania (East of Pittsburgh)	5.58
Pennsylvania (West of Pittsburgh)	4.20
Philadelphia & Erie	4.71
Average	5.23

It will be noticed that in a number of these cases the figures are much below those of the first statement, the average of the whole being 1 37 lbs. less.

Taking an average of the two we have 6.07 lbs. per freight car mile, which may probably be taken as a fair average figure for American roads. This, however, is about 60 per cent. more than the two-cylinder compound used on an average for two years' work upon the East Tennessee, and upon grades it is believed equal on an average to those of the roads included in the above statements. We believe we are justified in claiming for the freight compounds for the two years the same superiority, so far as the consumption of fuel is concerned, as was shown during the former year, and as was shown by the passenger engines for the two years.

Repairs.—The item of repairs is the one on which the *doubters* harp, claiming that the saving in coal, if it be cheap, is so small that it is more than made up by the increased repairs of the engines. The statement for last year showed for the 10-wheeler in passenger service:

	Miles.	Cost.	Cost per mile in cts.
2 simple 6 months	69,220	$1,213.12	1.75
1 compound 6 months	29,864	527.51	1.77
For the present year it was:			
2 simple	144,652	$3,763.88	2.62
1 compound	68,170	1,831.33	2.68

While we have an increase here, the relations are about the same.

Combined we have:

2 simple, 1½ years	213,872	$4,977.00	2.33
1 compound, 1½ years	98,034	2,358.84	2.40

Here seems to be a slightly increased cost for the compound, or about three per cent., which would amount to about $23 per year, while the coal saved would amount to 850 tons, or say about $1,275, at $1.50 per ton, a sum so much more than the additional repairs, even if the excess was ten times $23, as to make the compounding valuable beyond question.

As to the freight engines our last year's statistics were:

	Miles.	Cost.	Cost per mile in cents.
Four simple engines	76,827	$1,312.66	1.70
Two compound engines	39,268	612.72	1.55

For the year just passed we have no engine exclusively on the same runs as the compounds. We, however, have taken 11 simple engines of the *same age* as the compounds that have been run in about the same character of service and during the year averaged about the same mileage, though not on the same part of the road. This, for car mile comparison, would not do, but for engine mileage is certainly not objectionable.

The figures for the year are:

	Miles.	Cost.	Cost per mile in cents.
11 simple engines	370,655	$8,651.62	2.33
2 compound engines	68,503	1,690.46	2.47

Now combining the two years, or one and one-half years, more properly, we have:

4 simple engines, 1891	76,827	$1,312.66	1.70
11 " " 1892	370,656	8,651.62	2.33
Total	447,482	$9 964.28	2.23
2 compound engines, 1991	39,268	612 72	1.55
2 " " 1892	68,503	1,690.46	2.47
Total	107,771	$2,303.18	2.14

Here we find that while for this year the repairs of the compounds were a trifle more per mile run, but for the year and a half considered the repairs were a trifle less. It must be understood that those figures do not include any general overhauling, but simply the running repairs of such work as is done from day to day between trips. It has been claimed that the large cylinder would wear upon the bottom much more than upon the sides, caused, perhaps, by the greater weight of the piston. An examination of the cylinders of four engines, two simple and two compound, showed that the wear in the cylinders, as shown by the increase in vertical or horizontal diameter, was as follows:

	Simple.	Compound.
Right hand cylinder	.0000 in.	.0095 in.
Left hand cylinder	.0:05 in.	.0255 in.

It will be noticed that the elongation in the right hand cylinder as a rule is the most The average of the four engines is as follows:

Right hand	.0545 in.
Left hand	.0291 in.

Another singular fact was developed, viz., that the extra wear was apt to be quite as much at the top of the cylinder as at the bottom, regardless of kind of engine. To provide against any wear of this kind, the piston rods have on later engines been lengthened and a bearing obtained at both ends of the cylinder, the front end of the rod running into a pocket prepared for the purpose. The effect of this seems good, and it, perhaps, would do as well applied to the simple engines. A careful examination of the pins was made to ascertain what, if any, difference in wear was to be found there, either as between the engines or sides of the engines, and no measureable difference was found; almost absolutely no wear was discoverable. This examination into wear of the cylinders is not enough to be of any special value, except as an indication that there is probably no material increase because of the increased size of cylinder.

We believe that our examinations into the performance of these engines confirm the impression formed years ago, and that we can do no better than to repeat with emphasis the concluding sentence of the former paper, viz.:

"It seems safe to conclude that the compound principle as developed in these engines is a valuable improvement upon the simple engines, and that the increased economy in fuel is of sufficient magnitude to more than overcome any possible increased repairs."

The Ochta Armor Trial.

The particulars of the recent competitive trial of armor plates at Ochta show that it gave very important results. The five plates entered for the recent competition were a St. Chamond, low-carbon nickel-steel, supposed to have had a lead bath; a Brown compound plate, made on the Ellis patent, and surface hardened by the Tresidder process, an English plate; two Cammell nickel steel plates, one high and the other low carbon; finally, a Harveyized plate, made in Sheffield by Vickers. Each of these plates, under the prescribed conditions of the trial, was 8 ft. high by 8 ft. wide and 10 in. thick, with a backing, but no frame. The test was to

* See *Railroad Gazette*, Sept. 18, 1891.

be six rounds with a 6-in., breech-loading, rifle using Holtzer projectiles. The weight of the projectiles seems to have been 75.6 lbs. The muzzle velocity was 2,235 ft. per second, but the striking velocity, the target being several hundred feet distant, was 2,170 ft., and the striking energy 2,470 foot-tons. It may be remarked that while the striking velocity in our tests at Indian Head with 6-in. guns was but 2,075 ft., the projectile weighed 100 lbs., making the striking energy 2,988, or over one-fifth greater in the American than in the Russian trials.

In each of the six rounds the Cammell low-carbon plate showed no cracks, but was deeply penetrated and the projectile was unbroken in five of the trials. The St. Chamond plate showed about the same results, but broke the projectile in two instances. The Cammell high carbon plate was destroyed in the first three shots. The Brown plate began to crack with the first shot and was destroyed by the fifth.

For four shots the Harvey plate was left without cracks, and instead of being penetrated 10 or 12 in., as the best of the other plates had been, it destroyed the projectiles. Then two shots were fired with a 9-in. gun and a 406-lb. Pulitoff Holtzer projectile of 1,650 ft. and 1,875 ft. striking velocity. The plate was cracked in the fifth round and demolished in the sixth, but in each case the projectile was broken up and the wood backing was not penetrated.

Two Canal Projects.

Projects for two canals or systems of navigation for east and west transportation have lately been brought before the country with some prominence. The first project is to connect the Lake of the Woods and the lakes and watercourses between it and Lake Superior with Red Lake and, through the Red Lake River, with the Red River of the North. It is probably quite within the range of practicable engineering to connect the 1,400 miles of steamboat navigation on the Saskatchewan with this proposed improvement, though whether it would be a cheaper route to build than that from Red Lake through Lake Pokagema, the upper Mississippi and the St. Louis River to Duluth may be doubted. Such a canal, if built, would in a short time develop a traffic which would call for another lock at the "Soo."

News of the other project comes through the *Official Gazette*, published at Ottawa, and sets forth that an international syndicate will apply to the Dominion authorities for a charter for the International Navigation Co., which will endeavor to connect Lake Erie, Montreal and New York City by a 20-ft. navigation, with locks 22 ft. draught, 50 ft. wide and 450 ft. long. The length of canal to connect Lakes Erie and Ontario will be about 24 miles. The fall of 326 ft. is to be overcome with four locks, and the canal passed in four hours. From the foot of Lake Ontario the canal is to be held up past Galops Canal, Rapide Plat Canal, Farran's Point Canal and the Cornwall Canal to Lake St. Francis, which is to be entered by a lock of 84 ft. lift. This is doubtless good engineering, as it must save a large part of the dredging in the St. Lawrence River, the expense of which has always been held to be prohibitory when a 20-ft. navigation of the St. Lawrence has been proposed. From Lake St. Francis one branch will descend by a lock of 82 ft. lift into Lake St. Louis and by another lock of 45 ft. lift into Montreal harbor. The other branch will descend into Lake Champlain by a lock of about 50 ft. lift, and passing up that lake cut through the divide into the Hudson River, descending to tide-water at Troy by one lock of about 35 ft. lift.

Between Lake Erie and Montreal there will be seven locks and 363 miles of navigation, of which 45 miles will be canal. Between Lake Erie and New York there will be seven locks and 706 miles of navigation, of which 131 will be canal. Between Montreal and New York will be four locks and 403 miles of navigation, of which 115 will be canal. The time from Lake Erie to Montreal will be 32 hours; from Lake Erie to New York, 60 hours. Between Montreal and New York the time will be 38 hours.

When we remember that over eleven million tons passed through the "Soo" canal this season, that over thirty million tons pass Detroit, and that the traffic of the Hudson River is estimated at eighteen and a half million tons, it will probably not be thought an extreme statement to say that a traffic of twenty million tons would be offered to such a canal if it had sufficient capacity to handle it and was free from tolls. Besides this a through cut from Lake Champlain would so add to the waters of the Hudson River as to be of great use to its navigation.

As these locks are to pass masted vessels it will be necessary to have the gates of the full height of the combined draft and lift, but they probably will not strike the capitalists with such force as the cut from Lake Champlain, some 50 odd miles in length toward Troy, which has a 12-mile summit at Sandy Hill 150 ft. above tide water and 54½ ft. above Lake Champlain.

The Railroad Accounting Department—Its Uses and Abuses.

BY AN AUDITOR.

Its Functions.—In the accounting department are kept the books showing the financial transactions of a railroad of whatever nature, and when properly organized it should have all papers on file, or immediately under control, to sustain the entries on such books. Its duties may be stated more explicity as follows: All reports from agents and conductors showing tickets sold, freight shipped and cash collected are audited, copies of waybills and manifests, canceled tickets and coupons of tickets being forwarded to it to sustain the report. Accounts of individuals and companies in favor of or against the road are treated, contracts are construed and their financial results covered. Vouchers for disbursements are scrutinized and certified to or rejected, as the case may be, and if correct duly entered on the books. Coupons paid on account of interest on the funded debt are received, examined and the proper entries made. Receipts and disbursements are duly recorded and a daily check made of the Treasurer's cash. Pay rolls are examined, certified to and proper distribution made of the amounts involved to the respective expense and capital accounts. Careful account is kept of the stock of material on hand and its distribution. Weekly estimates of the earnings are made, and monthly and annually statements of the earnings and expenses are compiled, supplemented with balance sheets and detailed statements. In other words, no transaction involving money, directly or indirectly, can be made without the knowledge in full detail of the head of this department. It is clear that a vast responsibility is imposed upon its chief, since the accuracy of the figures showing the results of operations presented to owners and the public depends upon his ability, experience, industry and integrity.

When this department is not improperly interfered with by the management accurate statements are generally made, and all interested have a fair opportunity thereby to estimate the value of any property in question, *per se*, and as to its earning capacity, as well as to judge of the capability of those intrusted with its management.

Results of Interference by Superior Officers.—In the case of a road that is prosperous from the fact that it has a large volume of traffic at fair rates, there is no inducement for the management to interfere, and this department may be reasonably sure of a continuance in office, although its personnel may not be able, and prosperity arise from conditions and causes entirely beyond its control. The same may be said also of that class of roads that have been made prosperous and continue so through the ability of its operating officers. But when, through the operations of competing lines, the manager of a road finds that the revenue is falling away largely while the expenses are at a minimum, that he is unable to cope with the situation and fears a loss of position if the facts become known, the temptation to "cook" the accounts is very great.

One of the favorite methods of cooking is as follows: When it is found, in making up the monthly statements, that the expenses are largely out of proportion to the earnings, the former are reduced so as to make a fair showing and the reduction charged to "suspense account," thus setting up the net earnings to about the usual amount, and trusting to future months when earnings may be greater to credit the "suspense account," and charge expenses; but if there are no such months prior to the end of the fiscal year, it is charged off to "Profit and Loss." Meanwhile, on the condensed balance sheet, it is concealed by combination with other accounts. This suspense account would stand on the debit side of the balance sheet as a fictitious asset—means which have been expended but not applied.

To illustrate: A few months since a New England road changed hands, and the daily press informed us that the following manipulation of accounts was discovered: "At a meeting of the directors the General Manager would present each month a financial statement showing regularly a surplus over expenditures. In November this surplus was $30,000, according to figures presented by him, and yet at the end of the fiscal year Dec. 31 there was a deficit of $138,000. This was a complete surprise to the directors, who had taken without question the monthly statements. When an examination was made by accountants it was discovered that a system had been adopted in keeping the books by which funds were carried forward as assets that had actually been disbursed, and apparently the one end in view was to make a fine showing on the books of the management."

Without going into details, other methods of cooking may be mentioned, such as: Unequal distribution of taxes and insurance in statements of monthly expenses; crediting expenses of the current year with judgments obtained on account of suits originating in previous years; keeping amounts charged to material accounts after the material has been used; carrying expenses belonging to the current year to the following year; increasing inventories of material on hand at the close of the year, arbitrarily, to the end that the excess over ledger accounts may be credited to expenses; increasing gross earnings by crediting freight on the company's material; crediting profits shown on balance sheets of corporations, owned or controlled, accruing in past years, to current expenses; charging renewals of equipment, bridges, etc., to capital accounts instead of expenses.

Freight Accounts.—In auditing these the following irregularities are found: Paying rebates directly, but making vouchers therefor in indefinite language without sustaining papers. Waybilling from a competing point on a line when the real shipping point is non-competitive, so as to obtain lower rates over the foreign road. Having shipments made from a distant competing point beyond the initial or junction points to competing points beyond the terminal or other junction points and stopping the goods on your line, so as to give your patrons a proportion of a cheap through rate, or avail yourself of it in the matter of company's material. Indirectly giving rebates by permitting shipments free over a part of a line to a certain point without regular waybilling, and then have them duly waybilled from that point as if originating there. Paying shippers salaries and commissions, hiring their clerks, renting their buildings or docks, hiring their cars, paying for their telegrams, drayage and switching, giving specific sums to have freight diverted to a line, furnishing free passes, taking advantage of milling-in-transit to make local rate from milling point the same as the balance of the through rate when desirable, placing more tonnage in cars than waybills call for, classifying commodities falsely, etc., etc.

Ticket Accounts.—The irregularities in the passenger department are as numerous as the ingenuity of its officers are able to devise. The following are some of them: Paying exorbitant commission, selling limited tickets at low rates and refunding value of unused portion after date of limit has expired, or extending date; giving free passage to influence business; selling second class tickets with privilege of Pullman sleepers; furnishing scalpers tickets to sell at low rates and covering up difference between rates sold and regular rates with commissions, salaries, etc. Apropos of this last I have known regular tickets to be sold from Chicago to New York for $11 each, when the rate by the differential lines was $18, and by the others $20, and no rate war was prevailing. It is no uncommon thing for tickets representing thousands of dollars to be sold to scalpers at low rates for cash. One sale, it was said, was made amounting to $50,000, some two years since.

In the foregoing I have endeavored to show how false statements of earnings and expenses are made and the reasons for them, as well as the devices of the traffic department to obtain business, in defiance of the Interstate Commerce law, the edicts of national and state commissioners and the agreements of traffic associations.

The Remedy.—The true and only remedy for these evils that will be effective is to make the accounting department independent of the control of the managing officials; then, as all details are passed upon by it, correct statements could be made of financial affairs, and both passenger and freight rates maintained, as agreed upon, for a stated period, *for no agent could ship freight or sell tickets at less than tariff rates without being charged with the difference, and no fraudulent vouchers could be made to cover rebates.*

Pools may be legalized, division of traffic may be made on the basis of tons and passengers, and rates agreed upon, but satisfactory results will never be reached by such methods until the figures presented as bases by the respective roads are made up by an independent comptroller or auditor without manipulation by interested officers of the traffic departments. Many of the great traffic associations of the West have gone out of existence, while others are on the brink of dissolution, because they depended on the good faith of officers in the traffic departments, who had been trained in Spartan schools.

How can this independence be secured? It has occurred to me that, if Congress could be prevailed on to pass a law that the chiefs of accounting departments should hold their positions during good behavior, and be removed only by the Insterstate Commerce Commission upon charges preferred and after a trial in which all parties could be heard, the result would be attained. Again, it might be possible for traffic associations, if legalized, so that their dicta could be enforced, to agree that such chiefs should be removed by them only, otherwise to remain for life or till superannuated, and thereby independence be assured and reference to Congress avoided.

The remedy suggested is novel, but reasonable, and since the great majority of presidents and managers of railroads are honorable men and would be glad to have all lines make proper reports and subordinates attend strictly and conscientiously to their duties, as would the great bankers, who are interested so largely, why should they not combine and use their potent influence in the direction outlined, provided they believe these suggestions have merit?

The Railroads in Atlanta.

Atlanta also has its railroad problem. It is already a railroad centre of considerable importance, and its importance is growing. Like most American cities, however, there has never been any systematic plan for arranging the railroad entrances with regard to future development, and the loss, inconvenience and danger of the present situation have become serious enough to demand attention. Some weeks ago Mr. E. L. Corthell made a report to the Mayor of the city on the condition of the terminal facilities there, and the methods of improving them, which has doubtless been brought to the attention of very few of our readers. We give below enough extracts from this report to indicate the conditions that exist, and the remedies which Mr. Corthell proposes.

Atlanta is a terminal point for a great network of railroads extending from the city as a centre in all directions. There are 11 railroads occupying a very inadequate and inconvenient union passenger station in the centre of the city. . . . The union station with its approaches is located directly across three of the most important business streets of the city. The railroads divide the city into two distinct parts. The interference of the street and railroad traffic is excessive to say the least. In fact it may be said advisedly that it would be difficult to find anywhere in the world worse grade crossings than the two at Pryor and Whitehall streets.

On my request you have had a careful count made of the street and railroad traffic in 12 hours on Aug. 27, from 6 o'clock a. m. to 6 o'clock p. m., at the crossing of

Pryor street. This count was taken each hour. The totals for 12 hours are as follows:

Number pedestrians crossing the track	16,326
Number teams crossing the tracks	1,144
Number people in teams crossing the tracks	1,506
Total	17,832
Locomotives with trains of cars crossing the street	108
Locomotives without trains of cars crossing the street	63
Passenger cars with people	159
Number passengers in cars	2,165

The maximum hour of street travel was between 5 and 6 p. m., when 2,051 people crossed the tracks and 113 teams. There were in that hour twenty-two train movements across the street, or one in less than every three minutes of the hour, while the average of teams was nearly two each minute. Thirty-two people crossed the tracks on an average each minute, or one each two seconds during the hour.

The count was also taken at Whitehall street crossing on Sept. 12, from 6 o'clock a. m. to 8 o'clock p. m., with the following results for the 14 hours:

Number of pedestrians crossing the tracks	26,839
Number o teams crossing the tracks	1,716
Number of people in teams crossing the tracks	2,284
Total	29,123
Locomotives with trains crossing the street	164
Locomotives without trains crossing the street	109
Passenger cars with people	91
Number passengers in cars	2,661

There are nine tracks crossing Pryor street, six crossing Whitehall and seven crossing Loyd. It is impracticable to close the track areas in the blocks against public travel by gates or fences. The entire area from the station to Forsyth street is open to the public to travel on at will in any direction, and it is very difficult for the railroads to prevent it. These features greatly aggravate the evil.

The money loss to the public in time is hard to estimate, but careful consideration of the facts places it at not less than $75,000 per annum at the three crossings, or $1,500,000 capitalized at five per cent. The loss of time to the railroads also is very great. They are now compelled by the street conditions to move their trains at a speed of not over four miles per hour, which is about one-sixth of the speed which they could employ in approaching the station if the street obstacles were removed. . . .

To maintain such an evil as these crossings amount to does not seem to be the way that well-conducted communities should transact their business, and it should not be necessary, after stating such facts as the above, to argue the case at all. The railroad companies and the city should without hesitation or delay, unite on some well-considered and practical plan to abate the nuisance.

Before discussing plans for relief from these grade crossings the situation of the Union passenger station should be explained. The entire length of the station is 367 ft., with a grade crossing immediately in front of each end of the station. The entire width available for tracks is about 95 ft. with one track entirely outside, where an important railroad has to place its trains and handle its passengers, baggage, express and postal business. The entire width of the building is only 120 ft., and not only must the tracks and platforms be placed in this width, but also the waiting and baggage rooms and offices and the passengers must often cross several tracks in entering or leaving trains. The confusion and annoyance by this method of handling passenger business is extremely great. In making up trains it is necessary to leave space between the cars on one track in order that passengers may pass through to their trains standing on other tracks. This compels the locomotives, and even the postal and express cars, to stand outside onthe west side of the street in the space between Pryor and Whitehall streets, and there to receive and discharge postal and express matter, exposed to the weather. It may safely be said that the station evil is surpassed only by the grade crossing evil.

To remove the union station out of the centre of the city might ameliorate the grade crossing conditions to some extent, but there would still be left many tracks through the city which would be almost constantly covered with moving trains and cars, which would be switched forward and back as now over all the crossings. Furthermore it may be laid down as sound railroad policy to obtain and maintain passenger and freight facilities as near the centre of a city as possible, for the convenience both of the railroads and the public. It is a mistaken policy to retire the stations to the outskirts of the city, as has been done sometimes in this country. We should therefore not think of moving the union passenger station away from its very desirable location.

There can, therefore, be only two methods left of accomplishing our purpose. First, to place the streets over the tracks. Second, to place the tracks over the streets. . . .

The physical and property conditions make the first plan in my opinion impracticable. . . . It would be difficult to form a close estimate of the damage to the property, but it would be a very large sum. The three viaducts with such long approaches would cost not less than $500,000, and, judging from the damages in other cities and the great value of the property affected here, the damage to property and the cost of raising it would not be less than from $1,700,000 to $2,000,000. To this estimate must of course be added the cost of a suitable union passenger station, which should not be placed at less than $400,000, making a total minimum cost of $2,000,000. I do not think even at so great a cost the plan could be made satisfactory. The loss and damage to the city at large by disfiguring its best business buildings and blocks and by changing the elevations and grades of the streets cannot be overestimated. . . .

The second plan is to place the tracks over the streets . . . . The plan is given in some detail in order that a full and clear idea may be had of what is proposed. . . . I placed the data in the hands of Mr. Bradford L. Gilbert, of New York, one of the leading railroad architects of the United States, and my estimates are based on his suggestions. . . . . The station would extend a total distance of 675 ft., and from the curb line of Wall street to the sidewalk line of the buildings south of the station. The trainshed would have a width of 175 ft. for a length of 385 ft. and a width of from 175 to 150 ft. for a further length of 142 ft., or a total length of trainshed of 525 ft. This trainshed might be made 600 ft. long by extending it east of Loyd street. The waiting rooms and office part of the station would have a width of from 150 to 128 ft., and would be 110 ft. long with a loggia in front at Whitehall street 120 ft. wide and 40 ft. deep for carriages to drive under. Whitehall street would be floored over to make an entrance space on the outside at the elevated level. This space would be 120 ft. on the line of the street and 50 ft. wide. A driveway 40 ft. wide and two walks, each 10 ft. wide, would be built elevated from Whitehall street to the Broad street bridge, a distance of 300 ft. It is assumed that the present Broad street bridge is to be removed and a new deck bridge erected in its place.

Inside of the trainshed there would be two 20-foot spaces or platforms on each side for baggage, express and postal business, then double-track spaces four in number, making eight tracks in all, with 15-ft. platforms between the double-track spaces, with one platform 10 ft. wide. The elevated level of the station would extend from the curb line at Loyd street to the curb line at Pryor and Wall streets and from the latter point to the curb line at the northeast corner of Whitehall, Peachtree and Wall streets. The structure would be erected through Wall street on steel posts with space for the street to be left underneath. It is proposed to have an entrance on the present level of Whitehall street by means of a loggia as arranged for in the elevated level, so that passengers, either by large elevators or by stairways, as at Broad street station, Philadelphia, can ascend and descend to the two levels. The baggage, express and postal matter are to be handled by hydraulic elevators, as at the new Jersey City station of the Pennsylvania Railroad. The station is to be an elevated head-on station, like the above-mentioned stations. Passengers will have exits also for leaving the station by elevators and stairways at Loyd and Pryor streets. There will be arranged well-lighted subways under the tracks in order to reach points of departure of trains, also stairways leading from these subways to the platforms so that passengers need not cross the tracks in order to change cars standing on different tracks. The carriage entrance will be as above described on Whitehall street and at the two levels, the ground level to be reached immediately from the street, the upper level by driving through from Broad street. The entire lower and upper floors of the loggias and the entire station are to be paved with asphalt. It is proposed to build a structure that will be an ornament to the city. The clear height of the elevated structure over the streets is to be 16 ft., the tracks on the upper level to be 20 ft. above the present tracks.

The entrances to the city and the union station would be by a belt line or inclines. [The details of these we omit.—Editor].

I also had in view arranging freight terminals of several roads which now have none in the city. . . . The plan proposed for a new union passenger station and for an entrance to it, and the construction of the proposed belt, would make it possible, and no doubt advisable, to arrange for a more extensive suburban business than there is at present. The double track elevated road on Loyd and the other streets above mentioned would be about a mile in length. Stations like those of the New York Elevated could be established at proper intervals for a city business, and the suburban business could be extended into the outlying districts.

The city gains the abolishment of the three principle grade crossings, which is worth to it certainly what three viaducts over the streets would cost, like that now being erected at Forsyth street, which the city pays for, costing over $100,000, to which should be added the amount for contingent damages to property. The plan proposed for the union passenger station and the incidental abolishment of the grade crossings entails no damage upon property and in effect builds three viaducts over the tracks. It would seem that the city should be willing to pay $300,000 toward the improvement. If this cannot be arranged for, or if there should be serious objections to it, the city would no doubt be willing to pay the interest on this amount at five per cent., or $15,000 per annum for, say 15 years, when it would be expected that, with the large increase in business and the entrance of new roads, the railroads could arrange to meet the interest and eventually to pay the principle of this $300,000 . . . The total cost of all the work proposed, including the Loyd Street Elevated and its double track connections at each end, with cost of property required, the union passenger station, the elevated approach on the west from Broad street over Whitehall, the incline of the Western & Atlantic, the hydraulic plant for elevators, the supervision, engineering and incidentals, is $2,500,000. The estimated amount of income and saving over the present structure and methods is capitalized at five per cent. $5,420,000. The cost of the union freight station has not been estimated.

Railroad Extension in England.

BY W. M. ACWORTH.

A railway company in England can neither acquire a yard of land nor raise a pound of capital without the special sanction of an act of Parliament, and that sanction is only given each year to companies which have given formal notice in the previous November of their intention to apply for it. Consequently we know now in December, 1892, what is the railway programme for the session of 1893; and we can see that both in quantity and importance the bills to be introduced are much below the average of recent years. It is true that all the great companies have, as usual, what are known as "Omnibus Bills," authorizing a multitude of petty improvements, the widening of a line here, the purchase of land for a new station there, the closing of a public road or footpath in a third place, or the establishment of a hotel in a fourth. But of new schemes there are none of the first importance and only two or three that have anything more than local interest.

In London there are two new electric railways projected on what I must call—*pace* the *Railroad Gazette*—the "Greathead system." The one is to run from Clapham Junction under the river and beneath Hyde Park to Paddington, the other from Victoria Station to Kilburn, a quarter of London at present singularly destitute of railway accommodation. To open up a new district for suburban residents a line is projected to run among the chalk hills, which lie behind Epsom and Croydon.

Of small railways in Cornwall and Shropshire, in Pembroke and Aberdeenshire, there is no need to speak. But the proposal to extend along the coast from Seaham to Hartlepool, the little Seaham & Sunderland, a line chiefly used for the carriage of coal and belonging entirely to the Marquess of Londonderry, is not without public interest, as it is one sign among many of the growing impatience of the inhabitants of the northeast of England under the almost absolute monopoly of the North-Eastern Co. A few weeks back it looked as though that monopoly was going to be assailed in much more serious fashion. For the newspapers were full of a project for a new line from Manchester to Newcastle, and on to Glasgow *via* the Tweed Valley, and public meetings in support of the scheme were held in Newcastle, Sunderland, Hartlepool and the adjacent towns. A characteristic illustration of the ignorance common in this country on railway matters is found in the fact that the projected line got christened the "Manchester & Glasgow Direct," its route being in fact about as direct as though one should go from New York to Boston via Albany. It seems impossible to learn who are really the promoters of this scheme, which, though abandoned for this year, is, we are assured, to be brought forward again next year. One would be inclined to guess that the roundabout route of the "Manchester & Glasgow Direct" is due to the fact that it is an amalgamation of two independent schemes, the one for a line from Manchester to Newcastle, the other for a line from Newcastle to Glasgow. Roundabout as the route is, it is still too direct for the people of the Durham coast towns, who have passed resolutions that no scheme can satisfy them which proposes to serve them by branch lines instead of putting them on the main trunk.

There are two little projected lines in the recesses of the northwest Highlands of Scotland which are not without interest. In the first place they both apply for aid from the public funds, probably the first instance of the kind on record in Great Britain, though Government subsidies to Irish railways are no new thing. Then both companies contemplate the possibility of their traffic being worked, not by the Highland Company, with which they connect, but by the Great North of Scotland Company, whose nearest station is at Elgin, some 80 or 90 miles away. Lately one of them, the Loch Maree & Aultbea Company, asks Parliament to say that the Highland Company shall pay over to it 25 per cent. of the gross sum received by the Highland Company for all traffic passing to or from the new branch. Such and even much larger rebates, given by old companies, to companies constructing new feeders, are common as matter of agreement, but this is probably the first attempt to make them compulsory. Whatever may be the abstract justice of the proposal, it is certain that the Highland Company, whose rates cannot average less than 4 or 5 cents per ton-mile, would still, after paying the rebate, be left with a handsome profit from traffic entirely created by the enterprise of others. It is certain too, if the remarkable figures given in Considère's "Chemins de Fer d'Interêt Local" are in any way typical, that such a rebate would mean a very considerable addition to the revenue of the Aultbea Company.

The policy of Parliament, as far as Parliament can be said to have a policy in railway matters, has always been strongly opposed to the ownership by railway companies of docks or steamships. Yet, year by year, railway companies acquire more docks and increase their fleets of steamers. Last year Parliament was invited to sanction the purchase of the Hull docks by the North-Eastern, and that of the Southampton docks by the South-Western. The South-Western Co.'s application succeeded; that of the North-Eastern passed one House, but was refused by the other. This year a new attempt is to be made by the North-Eastern, and is likely to succeed. The same fate will probably attend the reapplication made jointly by the London & North-Western and Lancashire & Yorkshire companies for permission to establish new lines of steamers between Lancashire ports and Ireland.

Two more schemes must be mentioned, both for amalgamation. The Midland & Great Northern companies are jointly applying to Parliament for powers to purchase the Eastern & Midlands, a small bankrupt concern, whose line has hitherto barely paid working expenses, but which, in the hands of two strong companies, is doubtless capable of great development, and will, in any case, act as a formidable rival at Yarmouth & Norwich of the Great Eastern, a company that at present has almost a monopoly of the eastern counties. Kent in the southeast corner of the country, is at the mercy of the rival lines, the South Eastern and the London, Chatham & Dover. Which of the two is the worse is matter of opinion. The common belief is that there is not much to choose between them, but that in all round badness, high fares, slow and unpunctual trains, worn out carriages and dirty stations, no other company in Great Britain can presume to rival the best of them. The Chatham, whose financial history is something like that of the Erie, has never paid a dividend on its ordinary shares. The South Eastern used to pay five per cent. and upward, but has been going steadily back for some years past. The shareholders of the South Eastern are now getting alarmed, while the directors of the Chatham are at their wits end to raise money for necessary betterments. In these circumstances a proposal has been brought forward and has received considerable support, for the amalgamation of the two undertakings. The companies compete at almost every point, at Dover and Canterbury, at Ramsgate and Chatham, and it is argued, from the shareholders' point of view, that if they were allowed to amalgamate they would be able, by suppressing superfluous competitive trains, to give a better and cheaper ser-

vice to the public; while, at the same time, securing more profit for themselves. On the other hand, it is argued, from the public point of view, that, bad as the service of these companies is at competitive points, it is infinitely worse to points where there is no competition, and that, though competition cannot do much to protect the public, at least it is better than no protection at all. What the upshot will be remains to be seen. At present, the South Eastern directors refuse to apply to Parliament for leave to amalgamate; but, their policy is, it is understood, to be directly challenged at the general meeting of the shareholders, in January next. This much is certain, that Parliament, while ready at all times to permit the absorption of small outlying lines, by the great companies, is very jealous indeed of the consolidation of competing undertakings. And before they get an amalgamation act, the South Eastern and the Chatham will have to make out a much stronger case in its favor, and give much more stringent guarantees for good behavior in future, than any that have so far been offered on their behalf by their sponsors.

Efficiency of Hydraulic Passenger Elevators.*

Modern elevators for passenger service are usually operated by means of a piston driven by hydraulic pressure, a method which fulfills very well the requirements of ease of handling, combined with smooth and rapid motion of the car. The hydraulic piston carries at the outer end of its rod one or more grooved pulleys, or sheaves, around which the wire ropes supporting the elevators are passed. By taking a sufficient number of turns of the ropes alternately around these sheaves and other fixed sheaves the speed of the elevator can be made any desired number of times greater than that of the piston. There are two principal methods in use for obtaining the water pressure necessary for propelling the piston, namely, the pumping or tank system and the hydro-steam system.

By the former, which is the older system and the one at present in more common use, the water pressure is derived either from an open tank on the roof, or from a closed tank having the upper part filled with air under the required pressure. In cities, or other places where water is expensive, the water which has done its work is received in a waste tank in the basement, from which a steam pump returns it to the pressure tank, the same water being used repeatedly. The choice between an open or closed pressure-tank depends upon circumstances. The closed tank has the advantage that it can be operated under as high pressure as may be desired while the pressure from an open tank is limited by the height of the building. On the other hand the open tank permits a somewhat more regular, and therefore more economical, action of the pump.

As the system is generally arranged, the upper side of the hydraulic piston is always in communication with the pressure tank. When the controlling valve is adjusted so that the water under the piston can escape, the piston is driven down, and the elevator car is raised. To lower the car a passage is opened between the two ends of the hydraulic cylinder, thus equalizing the pressure on the two sides of the piston. The latter is then raised by the unbalanced weight of the car, the water flowing around from the upper to the lower end of the cylinder. As the weight of the car is usually more than is necessary to give the desired speed in lowering, a part of it is counterbalanced by an iron weight, which serves also to reduce the work done by the water in lifting the elevator.

In the hodro-steam system the water acts only on the upper side of the piston. The counterbalance consists of a column of water contained in a closed cylindrical vessel called a receiver, located at such a height above the hydraulic cylinder as will give sufficient pressure to balance the desired fraction of the weight of the car. The connection between the piston and elevator car is by means of wire ropes passing around multiplying sheaves, as in other hydraulic elevators. When it is desired to raise the elevator, steam from the boiler is admitted to the top of the receiver, and, pressing on the surface of the water, forces it down into the working cylinder, driving the piston before it. To lower the car, the steam is allowed to escape from the receiver, when the weight of the car lifts the piston, and the column of water resting upon it, the water being forced back into the receiver. By closing a valve in the water passage between the cylinder and receiver, the elevator is stopped and held at any desired point. It is evident that with this system of working no pumping machinery is required. The successful operation of the hydro-steam system depends largely upon the perfect action of the water and steam valves.

The question of the comparative efficiency of the two systems is reduced to the question, whether, under the conditions of elevator service, more work can be done upon a hydraulic piston by applying steam pressure directly to the surface of the water, or by using the same quantity of steam to pump water into a tank, from which the supply for working the elevator is drawn. It is evident that in the hydro-steam elevator the principal loss will be that due to the condensation of the steam on the surface of the water, and on the comparatively cold sides of the receiver. This loss is reduced as much as possible by clothing the receiver with nonconducting material, and by preventing the agitation of the surface of the water by the entering steam. It is to be remembered also that in this apparatus the steam is always brought in contact with the same body of water, which remains permanently at a temperature of about 212 deg. Fahr.

In the pumping system, especially if a compound pump is used, the losses by condensation of steam will be smaller, but we have added losses due to leakage and friction in the pump and pipes. Moreover, under this system, all the water used has to be pumped against a pressure sufficient to raise the heaviest loads which the elevator has to carry, and just as much water, and consequently as much steam, is required to raise the elevator empty as to lift it with a full load of passengers. On the other hand, in a hydro-steam elevator, by applying a throttling governor, similar to the governor of a steam engine, to the steam supply pipe, the quantity of steam used on each trip of the elevator can be adjusted to correspond to the load carried, and a considerable saving made. By this method also the speed of the elevator is kept the same under all loads within the limit of its capacity. The attendant has only to open the steam valve wide, and as soon as the desired speed is attained the governor acts and prevents a too rapid motion.

It appeared to the writer that the only reliable way of striking a balance between these opposing elements of economy, would be by means of an accurate test of the two methods under the actual conditions of practice in passenger service.

Two tests were made to determine the relative economy of the two systems. The first test was of a hydro-steam passenger elevator in an office building, having a capacity of 10 persons and an average speed of about 300 ft. per minute. The whole travel of the elevator is about 60 ft., being three times that of the hydraulic piston. The cylinder is vertical, 12⅞ in. in diameter, and the piston rod diameter is 2in. making the effective area of the working piston 118 sq. in. The test was of about six hours duration.

For the second test a Knowles compound duplex pump of the latest pattern was used, which supplies water for ten elevators operated on the open tank system. The elevators are of the Otis vertical cylinder pattern.

The whole quantity of steam supplied to the hydro-steam elevator during its test was 2,057 lbs., and that the total travel of the working piston in lifting the car during the same time was 4,181 ft. The effective area of the piston being 118 sq. in., the volume of water that would be required to do this work under a pumping system would be 4,181 × 118 ÷ 144, or 3,426 cu. ft. The maximum effective pressure realized on the piston of the hydro-steam elevator was 77.3 lbs., and calling the ratio of pump pressure to effective pressure on the piston 1.25, the pump would have to force this volume of water against a pressure of 77.3 × 1.25, or 96.6 lbs. per sq.in. The quantity of work represented by these figures is 47,658,383 foot-pounds, which divided by 2,057, gives us the number of foot-pounds per pound of steam as 23,169. This is what a pump must do to equal the performance of the hydro-steam elevator under the conditions of this experiment.

The actual performance of the pump tested in foot-pounds per pound of steam was 23,234. The difference being less than three-tenths of one per cent., the writer concludes that the efficiency of the hydro-steam elevator as at present in use for passenger service is about equal to that which can be obtained with tank elevators operated by a good compound pump. Compared with the performance of the non compound pumps often used for elevator work, the hydro-steam system would therefore have a considerable advantage: and a further advantage may be gained, doubtless, by the use of the throttling governor in the steam pipe.

It is interesting to notice that the quantity of steam actually used per trip by the elevator in these experiments was about three times what would have been required to fill the receiver if there had been no condensation. A rough calculation also shows that the heat required to raise the temperature of the iron sides of the receiver from 212 deg. to the temperature of the entering steam is sufficient to account for the greater part of the condensation. It is therefore probable that a comparatively small proportion of the steam is condensed on the surface of the water, the depth affected being very small.

*Abstract of a paper read by Prof. H. B. Gale before the Technical Society of the Pacific Coast.

Tests of Resistance of Building Stones to Frost.

A circular detailing tests to be made of building stones to determine their resistance to frost has been issued by the Russian government to the various Russian railroad companies and government inspectors. Records of the tests are to be made by the various observers, and these records, together with the test specimens, are to be sent to the mechanical laboratory of the Russian Imperial Institute of Road Engineers, at St. Petersburg. The instructions for making the tests, for which we are indebted to the *Industrie Zeitung*, are substantially as follows.

The stone samples are to be submitted to low temperatures, artificially produced, being first saturated with water. Each sample is to be submitted to the low temperature a number of times. The apparatus to be used in making the tests is to consist of a wooden box (No. 1) with an outside felt covering. Inside of this box are to be two other boxes (Nos. 2 and 3), placed one within the other. Box 2 also is to be made of wood, with a thin sheet-iron lining. Box No. 3, however, is to be made of sheet zinc. The dimensions of the several boxes are to be such that each box will have a clear space all around it of from four to five inches. The space between boxes Nos. 1 and 2 will be filled with sawdust, while the space between boxes Nos. 2 and 3 will be filled with a refrigerating mixture, to consist of three parts (by weight) of finely broken ice and one part of common salt. Box No. 2 is to be made of such size that its sides will extend about four inches above the sides of the inside box No. 3, and the latter is to have a cover in the shape of a fourth, closed, flat box, which will virtually form also the top of box No. 2, and which also will be made of sheet zinc, and will be filled with a freezing mixture. The outside box, No. 1 is to have a wooden cover.

The test samples of stone are first to be dried at a temperature of 30 degrees C. (about 86 degrees Fahr.), then measured and weighed, and finally placed in water until they are thoroughly saturated. The samples are to be in the shape of a cube, with sides measuring 7 centimetres (about 2.8 inches). Sufficient saturation of the samples is considered to have been attained after a period of from 5 to 7 days, and its degree is to be calculated by dividing the difference between the weights of the sample after and before immersion, by the volume of the sample. Thus, if V be the volume of the cube; g', its weight when dry; and g, its weight after saturation; then the percentage of saturation with respect to volume is $\frac{g - g'}{V} \times 100$.

The sample to be saturated is, during the first 24 hours, placed in water only 2 centimetres (about 0.8 in.) deep. After that length of time it is completely submerged. The water used should be clean, and have temperature of from 15 deg. to 20 deg. C. (59 deg. to 68 deg. Fahr.)

After saturation, the samples are to be put in the freezing apparatus.* After each exposure in this apparatus, the samples should be carefully examined for indications of the frost effects, such as cracks and peeling off of flakes, and a sufficient number of exposures to the low temperature should be made to finally produce such effects. Still, if after 25 exposures the sample be intact, it may be accepted as having sufficiently demonstrated its frost-resisting powers. Samples of stones which have little or no frost-resisting power will clearly show the effects of the low temperature after from 5 to 10 exposures. The temperatures produced by the ice and salt mixture, ranging around the zero point on the Fahrenheit scale, are considered sufficiently low to admit of conclusive results as to the durability of the samples tested. The temperatures in the freezing apparatus are to be determined by placing a recording thermometer in box No. 3 together with each sample tested.

After the several exposures in the apparatus, the samples are to be further submitted to compressive tests to determine their comparative compressive strengths before and after saturation and freezing. In order to admit of arriving at such comparative figures, it is recommended to have six test pieces of each stone variety, three of them to be tested by compression when dry, and the other three after saturation and freezing. The compression tests can be made at the Imperial Institute, to which the test pieces and the freezing test records are to be forwarded.

*Nothing is said as to the length of the time of each exposure.—EDITOR.

TECHNICAL.

Manufacturing and Business.

The Lidgerwood Mfg. Co., New York, has recently established a branch office at 505 Main street, Louisville, Ky., which will be in charge of S. L. Avery, formerly president of B. F. Avery & Sons' Plow Works, as sales agent. There are over 9,000 of the Lidgerwood hoisting engines now in use.

The past twelve months have witnessed by far the greatest enlargement and most extensive improvements in the works of the E. W. Bliss Co. Brooklyn, N. Y., that have taken place during the history of the concern. After amalgamating with the business, that of the Stiles & Parker Press Co., it was decided to move the entire plant to the Brooklyn works. Partly to accommodate the increase of business, an additional building 150 ft. long by 90 ft. wide, and six stories high has been built. The machine shops now occupy an entire block, and enclose an erecting shop for heavy machinery, spanned by a 25 ton electric traveling crane. A large number of new machine tools have been put in, and some large special boring and milling machines are being made. Gigs and special devices for the rapid and accurate production of standard machines are being put into use more extensively than ever. A portion of the works has been equipped with special machinery for the manufacture of Whitehead torpedoes and torpedo guns, which are being made on contract with the United States Navy Department. All departments have been well filled with orders during the year, and the prospects are good for future business.

The Philadelphia office of the Pittsburgh Testing Laboratory will be discontinued on Jan. 1, and after that date the only executive office will be at 116 Water street, Pittsburgh.

The Lunkenheimer Brass Manufacturing Co. of Cincinnati announces that the name of the firm will be changed on Jan. 1 to The Lunkenheimer Company, with officers as follows: Edmund H. Lunken, President; C F. Lunkenheimer, Vice-President and Treasurer, and D. T. Williams, Secretary. The capital stock has been doubled and is now $500,000 and the new stock will be used to increase the manufacturing facilities and to introduce new specialities.

The Boston Car Wheel Co., Jersey City, N. J., has been incorporated with a capital stock of $100,000.

Iron and Steel.

The Hainsworth Steel Co. of Pittsburgh has been taken out of the control of the receivers, who were appointed in October, 1891, and the reorganized company is now in possession of the plant. Preferred stock to the amount of $111,000 has been issued to the creditors.

New Stations and Shops.

The Wilmington City Electric Co., of Wilmington, Del., has placed a contract for a new boiler house with the Berlin Iron Bridge Co. The building will be made entirely of brick and iron, from the designs of the Berlin company.

The Baltimore & Ohio has purchased property in Fairmont, W. Va., to be used as a site for a union station to be used by the Baltimore & Ohio, Fairmont, Morgantown & Pittsburgh, Monongahela River, and West Virginia & Pittsburgh roads. The plans for the building were completed some time ago, and work will probably begin in the Spring.

The Lake Shore & Michigan Southern has completed an elegant passenger station at Sandusky, O. It is made of Amherst buff stone with bluestone trimmings and is 36 × 117 ft. The interior woodwork is oak, finished with oil. The main waiting room is 38 × 48 ft. and the ladies' room (21 × 28 ft.) has cushioned seats and rocking chairs.

The Berlin Iron Bridge Co., of East Berlin, Conn., has secured the contract for a new iron fire-proof storehouse for the Pope Manufacturing Co., at Hartford, Conn. The building will be 40 ft. wide by 84 ft. in length, two stories high, and will be used for storing the separate parts of bicycles, as the Pope Manufacturing Co. has to carry a very large stock of different parts.

Aluminum for Engineers' Instruments.

Messrs. James W. Queen & Co., of Philadelphia, are making certain parts of surveying instruments of aluminum alloys. In form, size and detail these are the same as those generally made, varying simply in the material. In the transits, for instance, the standards, plates and heavier parts of the new instrument are made of aluminum alloy, while the centres, bearing surfaces, screws,

etc., are made of the usual gun metal and hard brass, the weight being thus reduced from about one-third to one-half without the sacrifice of efficiency or durability.

Burnside Shop—Illinois Central.

It is expected that the moving of tools from the old Illinois shops in Chicago to the new machine shop at Burnside will be begun in about two weeks. The machine shop at Burnside is now very nearly finished, and the shafting is being put in place. New tools to the value of about $65,000 have been ordered for this shop. The roundhouse at Burnside has been in use for sometime, and work on the other shops is progressing with reasonable rapidity. It is expected that the building which will ultimately include the machine and erecting shops will be used for all classes of work for a little as it is very desirable that the old shops at Weldon should be vacated and torn down as soon as possible.

Pantasote Leather.

Since describing this new substitute for leather in a recent issue,* some evidence has been obtained as to its durability, which is, of course, a most important point in a material designed for use in car upholstering. A chair cushion which has been in use for 18 months is still in fair condition and shows no sign of a crack or flaking off of the outside layers. The material has been subjected to some severe tests: boiling in salt water; exposed to the zero temperature; the direct rays of the sun in a hot day; the action of aqua ammonia, etc., and has stood all these tests in a way that would confirm the belief that it will prove very durable, though it has been so recently introduced that it has not been possible to apply as yet the test of actual wear for a lengthened period in railroad service.

The base of the fabric for car seating is a woven material, though paper is also used as a back when pantasote is not subjected to such heavy wear. It is made in various colors and with different surfaces—grained, embossed, etc., and, as far as present experience shows, will prove a very serviceable material for railroad use.

Dynamite Explosion.

Wednesday morning, last, about 100 lbs. of dynamite was accidentally exploded in the yard of the New York & Long Island Railroad Co. in Long Island City. Five persons were killed, and at least 15 injured. Two women were killed and six injured. Most of the casualities were to persons in neighboring houses. There was no injury to the tunnel works. The explosion was the result of carelessness in thawing the dynamite. The New York & Long Island Railroad Co. was organized in 1887 to build a tunnel from near the Grand Central Station in New York City to a point in Long Island City where it will join the line of the Long Island railroad. The work is being done by the Inter Island Construction Co. A shaft has been sunk about 100 ft. and headings are being driven from it.

The Cable Roads of New York City.

The present state of cable road construction in New York City is as follows: The track construction of the Broadway & Seventh Avenue road is completed from the Battery to Central Park and but little yet remains to be built between the Battery and South Ferry. The uptown power station at 51st street and Sixth avenue is practically completed and the machinery in place. The boilers were fired last Tuesday, and the cable, which is of steel wire wound on a hemp core and is 1⅛ in. in diameter, will be run in before the end of the week. At the downtown station, at Houston street and Broadway, the work is about one month behind that at 51st street, but it is expected that 125 cars will be in operation before March.

The Third Avenue cable road is completed with the exception of short stretches in front of the two power stations and at 125th and 129th streets and a short piece extending from the terminus of the East River Bridge to the end of Park Row. The east track over this length is now being built and when completed the west track will be put in. The up-town power station at 65th street is rapidly nearing completion, the building being now up to the second story. The down town station, at Bayard street and Bowery, is much behind the other, being barely up to the street level. This is due to the extensive and difficult excavation that was necessary in order to make room for the enormous machinery.

On the 29th inst. franchises for the construction of surface roads in Lexington avenue and Ninth avenue were to be sold. A company known as the Lexington Avenue & Pavonia Ferry Railroad Co. has been formed for the purpose of building and operating a cable road on Lexington avenue if they are successful in obtaining the frachise. The Broadway cable road will bid for the Ninth avenue franchise, and will introduce the cable if they get it. At all events it is probable that, owing to the municipal limitations to mechanical traction in the streets of the city the cable will be used on both these important lines.

Bids for a Sea Wall.

The abstract of bids received by Major D. P. Heap, U. S. A., Engineer of the Third Lighthouse District, for erecting a sea wall at the Lighthouse Depot at Tompkinsville, S. I., has been published. The lowest bid received was from Thomas J. Gilroy, who offered to erect the wall for the sum of $33,277; the next lowest bid was from R. B. Malone, of Philadelphia, who offered to do it for $40,662. For the cofferdam Mr. Gilroy asks $2,621, while the lowest bid after that is $10,913. For the concrete Mr. Gilroy's bid is $9,756, and the next lowest bid is $12,770. For the stone wall, on the other hand, Mr. Gilroy's bid is higher than any but one of the eight other bids; his estimate is $20,906; and one bidder, Colin McLean, offers to do it for $7,538. The only bid higher than Mr. Gilroy's for the stone wall is that of W. H. Flaherty of Brooklyn, whose estimate is $21,603.03.

* See page 923, *Railroad Gazette*, Dec. 9, 1892.

New Equipment of the "Big Four" Road.

The Cleveland, Cincinnati, Chicago & St. Louis has during the year contracted for 60 new locomotives, most of which have now been delivered, and 1,000 freight cars and over 50 cars for passenger service were also ordered. In May orders were let for 50 engines, distributed as follows: Brooks, 10 six-wheel 18x24-in. switch engines; these have all been delivered; Richmond Locomotive Works, 30 ten wheel freight engines, 19x24 in. cylinders, and of this contract four have been delivered and the rest will be delivered in January; Schenectady Locomotive Works, 10 eight wheel 18x24 in. passenger engines, to be delivered by Jan. 1. In September an order was given to the Schenectady works for 10 six wheel 18x24 in. switch engines to be delivered by Jan. 1. Five of these were received before Dec. 15. Early in the spring contracts were let to the Barney & Smith Car. Co. for 1,000 30 ton box cars with air brakes and vertical plain couplers, to be delivered by Jan. 1. The same company is also building 43 coaches, three postal cars and four combination cars, also two dining cars. Of this contract 10 coaches were delivered early in the year, and one dining car and 15 coaches are to be delivered by June 1.

Dredging Contracts for the Deep, Upper Lake Channels.

All of the bids for this work are now in, and if the lowest bids are in all instances accepted, the estimated quantity, 5,819,266 cu. yds., will be moved at a cost of $1,304,434, or less than one-half the cost estimated by General Poe. Considering the fact that this dredging has to be done to a depth of 20 ft. in all instances, and in some places to a depth of 22 ft., the prices bid are very low, and the amount of work involved is so large that our readers will probably be interested to see the table of last week so extended as to cover all the sections as below:

Sections.	No of Bidders.	Highest.	Average.	Lowest.
1. Round Island Shoals, 90,000 yds. clay, sand, gravel and hardpan	6	87 cts.	60.7 c's.	44 cts.
2. Little Mud Lake, sand, gravel and hardpan, 380,000 yds	5	42 "	57.89 "	25.9 "
3. Sailors' Encampment, 90,366 yds. limestone rock	6	$5.00	$3.57½	$2.43
4. Mud Lake Shoal, Sailors' Encampment, 67,000 yds sand, gravel and clay	8	46½ "	35.3 "	22 "
5. Foot of Lake Huron, 256,000 yds. sand, gravel and clay	7	$1.30	89.1 "	58 "
6. St. Clair Flats, 250,000 yds. clay and sand	13	34 "	23¼ "	16½ "
7. Grosse Point, 2,900,000 yds. clay and sand	11	41 "	28.14 "	14⅞ "
8. Mouth of Detroit River, 1,086,000 yds. sand and gravel	9	74 "	35.54 "	18 "

Both R. J. Cram, of Detroit, and McCollum & Lee, Essexville, Mich., bid 58 cents on Section 5. Cram was also the lowest bidder on Section No. 1, and John Hickler, of Buffalo, on Section 4. If this work was let at the average of the bids it would still be about 7 per cent. less than General Poe's estimated cost, so that everything connected with this letting must be very gratifying to the General, in view of his efforts to break up the almost criminal methods heretofore obtaining in Congress of making but one year's appropriation for work under progress. The *Railroad Gazette* has heretofore shown that in some instances the interest account during the prosecution of a large improvement has been about equal to one-half of the total expenditure, and General Poe estimated, we believe, that ability to let the whole work at one time would result in a saving of 33 per cent. The bids received seem to show that he rather underestimated the saving.

Victorian Railroads.

Members of the Colonial Legislature have made serious accusations against the working of the Locomotive branch of the Victorian railways, and Mr. Alison Smith, the Superintendent of Motive Power, asked for a full investigation. A board consisting of Professor Kernot and Messrs. A. P. Akehurst and A. W. Howitt, Police Magistrates, was accordingly appointed to inquire into the following charges:

1. Unsuitable stores have been procured in excess of requirements.
2. Stores have been ordered without calling for tenders, and contractors allowed to vary the character of goods contracted for.
3. A large quantity of teak timber was ordered from a non-contracting firm at a time that notice was given to the then contractors to discontinue supplying similar timber.
4. Rolling-stock which should have been repaired has been broken up, and unnecessary alterations made to rolling-stock.
5. Too many types of rolling-stock have been manufactured, and designs have been defective, and carried out without consultation with the branches interested.
6. Serviceable engines have been disposed of and unnecessary and unsuitable engines ordered.
7. Expensive experiments have been conducted, which have damaged permanent way and rolling-stock.
8. Engines and shops have been built without proper authority.
9. The working expenses of the locomotive branch have been unreasonably increased, and its administration has been wanting in economy and efficiency.

When the Board of Inquiry met, however, no prosecutor appeared and as the Acting Commissioner of Railways stated that no charges were made by him, the inquiry was apparently abandoned. As Victoria possesses far the best shops and rolling-stock of any of the Australian colonies, this is not surprising.

Contracts for Ore Docks at Two Harbors, Minn.

The Duluth & Iron Range has let the contracts for building additional ore docks at Two Harbors, Minn., to Winston Bros., of Minneapolis, and R. B. Dare, of Duluth. The contract includes 99 pockets of No. 3 dock, 84 pockets of No. 4, completing that dock, and 16 pockets in the shore end of No. 2 dock. This will increase the capacity of the docks nearly 35,000 tons, and the major part of the new docks will be utilized in the handling of ore from the Mesaba range. Over 6,000,000 ft. of dimension timber and more than 4,000 piles will be used in the construction of the additional docks. Work has already been begun by the contractors, and it is hoped to have the docks completed before the opening of navigation for the season of 1893.

Couplers and Draft Attachments.

The following circulars have been issued to manufacturers of patent draft attachments and the manufacturers of M. C. B. couplers by a Committee appointed by the Master Car Builders' Association, to report on attachment of draft rigging to cars.

To Manufacturers of M. C. B. Type of Car Couplers: Please furnish at your earliest convenience, for the use of M. C. B. Association Committee on Attachment of M. C. B. Couplers to Cars, complete detail drawings, or blue prints, of your coupler, with especial reference to the rear part, showing how it is designed to use yoke tail bolt and continuous drawbar attachments.

To Manufacturers of Draft Device for Railroad Cars: For the use of the M. C. B. Association Committee on Attachment of M. C. B. Type of Couplers to Cars, will you kindly furnish detail drawings, or prints, of your device, at your earliest convenience, with full description. Forward all drawings in response to both circulars to E. D. Bronner, Chairman, care of the Michigan Central Railroad Co., Detroit, Mich.

The Illinois Central, Rogers, Compound Locomotive.

The two-cylinder compound locomotive built by the Rogers Locomotive & Machine Works, which was delivered to the Illinois Central several weeks ago, is at work in freight service in connection with simple locomotives of the same lot of 25, and appears to be working very satisfactorily. It is not probable that any exact tests will be made of this engine, but the performance will be judged on the monthly coal reports as compared with the single expansion engines of the same general dimensions and in the same class of service. The single expansion engines have 19 × 26 in. cylinders, and carry 165 lbs. boiler pressure, and the compound engine has 20 and 29 × 26 in. cylinders, and the steam pressure is 180 lbs. A new design of intercepting and starting valves is used, which has some admirable features. Both of these valves are placed in the smoke-box, and the starting valve is connected with the reverse lever in such a way that it cannot be opened excepting when the link is in full gear in either forward or backward motion. The intercepting valve is a flap valve, and is operated in a manner which somewhat resembles the Worsdell arrangement.

Lecture Studies in the University of Chicago.

In the development of the university extension idea the University of Chicago has established what is called the lecture study department. The courses of lectures are inexpensive and may be delivered in small towns as well as large ones. The lecture studies are intended to interest and direct the student and to put him in the way to carry on his studies, as far as he chooses, in his own way. Weekly exercises are prepared at home and mailed to the lecturer. For 30 or 40 minutes before or after each lecture a class is held for the discussion of these exercises. Those who prefer to take only the lectures may do so. The whole scheme involves studies in a great many subjects, and among these is physics; and Mr. A. T. Woods, formerly Professor of Mechanical Engineering in the University of Illinois, and in Washington University, and now Associate Editor of the *Railroad Gazette*, has been appointed lecturer on physics, with special reference to modern applications of power. A synopsis of his lectures follows:

(I) Introductory: The Elementary Principles of Steam and Early Applications. (2) Marine Machinery: Review of elementary principles. Early forms of low pressure engines and boilers. Ericsson's air engine, etc. Principles of marine propulsion. Paddle wheels. Screw propellers. Successive steps leading to the most recent forms of engines and boilers. Illustrations of important features. Comparison of steamships, early and recent. (3) Locomotives: Early forms and ideas concerning railroads. Successive steps in development and the problems which were to be solved. Theory and practice. The locomotive of to-day. Description of salient features and comparison with marine engines. The power required to haul trains. Questions of speed and safety. (4) Stationary engines: Early forms wholly for pumping water from mines. Early mill engines. Condensing and non-condensing. Slow speed

and high speed. Examples of application to various industries. Pumps, mills, power stations. Gas and other motors. (5) Hydraulic Machinery: Means of utilizing water power. Early forms of water wheels and engines. Successive development. Modern water wheels, etc. Hydraulic hoists, presses, etc. (6) Transmission of Power: Various means of transmitting power from prime movers to point of application for long and short distances. The advantages of electric transmission. Principles of same. Electric railroads. Electric power in factories. Long distance transmission. Niagara Falls project.

The Harvey Steel Cars.

The total output of new cars of the Harvey steel car pattern has been 10 gondolas, 30 stock cars and 20 box cars. These have been in continual service from 10 to 18 months, and are claimed to have demonstrated in that time that steel can be used in car construction and reduce cost for maintenance not less than 50 per cent. the first year, and gradually increasing that to at least 75 per cent. the 12th year, or the end of the average life of the wooden car. The present plant is more especially adapted for repairing cars, and this work now amounts to 400 cars a month. The demand for this kind of work hasbeen very rapidly increasing, and if it continues it will be necessary to increase the plant very materially. The company is now carefully revising its plans for steel car construction, and in doing so has taken into consideration the first cost, cost for maintenance, and the easy interchangeability of the parts. In a few days the first car built on the new plans will be turned out. This will be a steel tank car, the frame being entirely steel, constructed in such a manner that any piece, if damaged, can be removed and replaced with as little cost as in a wooden car, if not less, while the liability of parts becoming defective will be at least 75 per cent. less than in a wooden car.

A Railroad Enterprise in Columbia.

Mr. E. J. Chibbas, Chief Engineer and Superintendent of the Caribbean Manganese Co., sails to-day for Colon, Republic of Columbia, to take charge of the work of developing the manganese mines owned there by the company. The first work will be to build a line of six to eight miles of railroad to the mines, which are situated about six miles from the port of Viento Frio, about 45 miles northeast of Colon. Preliminary lines have been run for the railroad and location and construction will now be pushed. The material for road and equipment will be bought in this country. The Caribbean Manganese Co. is a Baltimore concern.

THE SCRAP HEAP.

Notes.

The Indianapolis *Journal* reports that some of the railroads in that region are obliged to hire locomotive runners outside, because they have not qualified firemen enough to promote as fast as runners are needed.

The Duluth, Mesaba & Northern offices were in the Ferguson Block, Duluth, which was burned on Dec. 23. The railroad company occupied thirteen offices in the building and lost all its maps, profiles and other valuable papers.

The Philadelphia & Reading is to make a second attempt to sell anthracite coal in domestic sizes in Europe. A cargo is to be sent to Germany, and Captain John A. Schweers, a German employé of the road, will go over with some stoves to try and familiarize people with this fuel.

Thomas Collins, one of the men who attempted to hold up the Chesapeake & Ohio train, Dec. 13, and killed a passenger in the encounter which ensued, was convicted of murder in the first degree at Huntington, W. Va., Dec. 24. He will go to prison for life. Forgey, his partner, will be tried this week.

The Pennsylvania is to establish what is practically a new division, the lines in and near Philadelphia being separated from the New York, the Philadelphia and other divisions, and made into a division by themselves to be under a "Superintendent of Terminals." With this addition, the Pennsylvania proper will have twelve Division Superintendents. On the United Railroads of New Jersey there are three, and the Philadelphia & Erie has four.

Judge Speers, in the United States Court at Macon, Ga., has discharged the telegraph operators who were brought before him accused of contempt of court in abandoning their places on a railroad (the Central of Georgia) which was being operated by the court through a receiver. In making his decision, the judge took occasion to remark that the strike was mostly talk and vaporings, combined with newspaper articles. It is said that the judge advised the Receiver to reinstate the men who were discharged because they belonged to the Order of Railway Telegraphers.

Mr. H. A. Taylor, United States Commissioner of Railroads, is reported as believing that the bill funding the debt of the Pacific railroads and embodying his recommendations will become a law. His proposition is, in brief, to extend the debts 100 years, payments to begin at once, and all of the interest and a part of the principal to be paid semi-annually, additional security to be given by the railroads for these payments. Senator Frye, the Chairman of the Senate Committee on the Pacific Railroads, who has given the subject more attention than any other member of Congress, indorses the Commissioner's recommendations, and it is believed that a favorable report on the bill will soon be made by the Senate Committee. Senator Frye and Commissioner Taylor think the bill will pass the Senate at the present session, but its fate in the House at this time is problematical. Some of the subsidy bonds will mature within two years.

World's Fair Notes.

The Pottstown Iron Co., of Pottstown, Pa., has rolled a steel plate 150 ft. long and 20 in. wide by $\frac{7}{16}$ of an in. thick as an exhibition piece of work for the World's Fair.

The World's Fair Tower Company now offers an issue of five thousand shares of its capital stock at par, full paid and non-assessable. The capital stock is $2,000,000, divided into 20,000 shares of $100 each. An estimate of earnings is, passengers per hour, 10,000, allowing ten hours per day, equals 100,000, at 50 cents for each passenger equals, per day $50,000; 180 days that the Fair will be open, equals $9,000,000 revenue; from concessions and sale of souvenir books and medal, $400,000. Total, $9,400,000. An estimate of expenses is, operating expenses for the 180 days, $413,000; 25 per cent. of gross earnings to bepaid to the Exposition, $2,350,000. Total, $2,763,000; net, $6,637,000.

Houston Car Works.

Freight car works at Houston, Tex., are to be operated by the Houston Car Co., which has recently been organized by Boston capitalists. They have been given 13 acres of cleared timbered at Houston Heights, a suburb of Houston. An electric railroad runs to the property, and a belt railroad connects the property with the railroads having connections at Houston.

Ten box cars a day will be the capacity of the works at the start. The company intends to have the plant in operation inside of two months, and the equipment will be of the very best. The officers of the company are: J. M. Lunt, President; A. G. Frost, Vice-President; F. M. Frost, Treasurer; Geo. W. Beale, Superintendent. The works are now being erected, the shops being of the following dimensions: Planing mill, 76 × 200 ft.; paint shop, 76 × 200 ft.; erecting shop, 76 × 250 ft.; machine shop, 70 × 80 ft; blacksmith shop, 70 × 80 ft.; and engine and boiler house 50 × 75 ft. J. W. Duntley, representing the National Machinery Co., Tiffin, O., has received the contract for all the iron machinery; David B. Carse, General Manager of Greenlee Bros. & Co., Chicago, for all the woodworking machinery; and Col. J. H. Shay, of the Munson Belting Co., Chicago, for all the belting.

The Algeciras Railroad.

An English company has just completed a branch to the Cordova and Malaga line, which in time may become part of one of the world's great highways. for Algeciras is on the west side of the bay of Gibraltar and about 16 miles from Tarifa, which is only 12 miles from Africa. This new railroad, 109 miles long, starts from Boabdilla, and virtually puts Gibraltar within 60 hours of London, in place of five days by steamer. Heretofore the nearest railroad termini to Gibraltar were Cadiz, 10 hours, and Malaga, 6 hours, by steamers. Now the ferry, some five miles, should not take over half an hour. The road, which was an expensive one to build, having 14 tunnels and some high viaducts, ought to have present traffic in addition to its possible future from a connection with roads yet to be built in Africa, as from 5,000 to 6,000 steamers enter at the port of Gibraltar yearly.

The Jersey Central and the Coal "Combine."

The Central Railroad of New Jersey has filed a supplemental answer in the New Jersey suit, denying that the Central, either alone or in combination with the Reading, disobeyed any of the Chancellor's orders. The Central has done nothing to diminish competition in the trade in authracite coal or arbitrarily to maintain any increased prices of such coal to the people of the state. Neither has it increased the rate of transportation. Before the Chancellor's order was made the Philadelphia & Reading, with the Lackawanna, did raise rates, and the Central, which was then operated by the Port Reading, was going to join the movement, but declined to do so on account of the court's prohibitory order. The Central did, however, conform its rates on coal transported to tidewater for shipment beyond New Jersey to the rates then charged for the same service by other coal roads. This increased rate to tidewater was less than the rate that has been in previous years charged for the same service, and not more than a fair and proper price. The court's injunction, says the answer, has been fully obeyed and the appointment of a receiver is unnecessary, either for the purpose of seeing that the court's orders are obeyed or the interests of coal consumers in New Jersey protected.

Australian Trade.

The depression in trade in Australia still continues. The railroad earnings in New South Wales, hitherto the colony least affected, show a falling off of $200,000 for the month of October. The previous three months showed a decrease of $80,000.

Wheat and Corn in Store at Lake Ports.

The Chicago Board of Trade has ascertained that on Dec. 17 the following quantities were stored at the points mentioned:

	Wheat, bu.	Corn, bu.
Chicago	11,111,000	4,368,000
Duluth	12,184,000	.....
Milwaukee	2,208,000	20,000
Detroit	1,482,000	49,000
Toledo	3,579,000	275,000
Buffalo	4,844,000	271,000
Totals	35,408,000	5,187,000

Over 1,500,000 bushels of grain are now stored in boats at Chicago to be held through the winter and then delivered at Buffalo.

LOCOMOTIVE BUILDING.

The Chicago, Burlington & Quincy has ordered 25 10-wheel locomotives, class "K," of the Grant Locomotive Works.

The Colorado Midland placed orders last week with the Schenectady Locomotive Works for six narrow gauge locomotives for service on a branch now being built.

The output of the Baldwin Locomotive Works in 1892 is given as 670 engines, 210 of this number being Vauclain compounds. The number of engines built at these works in 1891 was 930.

The Duluth & Iron Range Road has just closed contracts with the Schenectady Locomotive Works for nine 12-wheel locomotives with 22×26 in. cylinders, 54 in. driving wheels and 72 in. boilers.

The Chicago, St. Paul, Minneapolis & Omaha has ordered five 19 × 24 ten-wheel freight engines from the Schenectady Locomotive Works. This road has just received a six-wheel connected-switch engine from the same builders.

The Cooke Locomotive & Machine Co. built 87 locomotives in 1892, including the following types; Eighteen eight-wheel engines with cylinders of the following dimensions: One, 16 × 24; one, 17 × 24; ten, 18 × 24, and six, 19 × 24 in. Two moguls, one with 17 × 24 and one 18 × 24 in. cylinders. Forty-two ten-wheel engines, cylinders as follows: Ten, 18 × 24; 22, 19 × 24; five, 20 × 24; four, 21 × 26, and one compound, 19 × 24 and 27 × 24. Twenty consolidation, with 21 × 24 in. cylinders, and six driver-switchers, with 18 × 24 in. cylinders. A rotary snow shovel was also built.

CAR BUILDING.

The Wells & French Car Co., of Chicago, has an order from the Duluth & Iron Range Co., for building 450 cars, to be equipped with air brakes and vertical plane couplers.

The Ohio Falls Car Co. has delivered two passenger cars to the Duluth & Iron Range. These cars are equipped with air signals and the Searles system of steam heating.

BRIDGE BUILDING.

Duluth, Minn.—The City Engineer has completed plans for a viaduct across the railroad tracks at Garfield avenue. The foundation and piers will, according to the engineer's estimate, cost $50,000, and the superstructure $142,000. There will be 20 ft. head room between the tracks and the viaduct, which will also carry the electric street railroad tracks.

Hartsdale, N. Y.—A new iron bridge is to be built over the Bronx River, near Hartsdale station on the New York & Harlem road. Part of the expense will be borne by the towns of Greenville and Scarsdale, N. Y.

Keyser, W. Va.—The County Commissioners of Allegheny County, Maryland, at a meeting held last week passed a resolution ordering the appointment of a committee to act in conjunction with a similar committee appointed by the County Court of Mineral County, W. Va., to select a site and estimate the cost of a highway bridge over the north branch of the Patomac river at or near Keyser, W. Va. Partial plans were prepared for the bridge some time ago. It will be about 200 ft. in length, and a steel structure is contemplated. The most available site is at the mouth of New Creek, near Keyser.

St. Louis.—The East St. Louis & St. Louis Bridge Co. has been incorporated in Illinois to construct a bridge over the Mississippi River in St. Clair County. The capital stock is $1,500,000, and the incorporators are Chas. G. Mitchell, Andrew C. Bryden and John Niems.

St. Paul, Minn.—The City Engineer has been instructed by the Board of Aldermen to prepare plans and specifications for an iron bridge across the right of way of the Great Northern Railway at Como avenue.

Sioux City, Ia.—The Pacific Short Line Bridge Co. has made an arrangement with the Phœnix Bridge Co., Sooysmith & Co., and other creditors for the work already done on the construction of the bridges, and last week work was resumed on the foundations by Sooysmith & Co. Most of the work on the first two piers has been finished and the draw pier will be completed at once. Work will also begin at once on the caisson for pier No. 4.

Spokane, Wash.—The County Commissioners are advertising for bids to construct a bridge across the Spokane at Cedar street.

Washington, D. C.—Assistant Engineer Feibiger has reported to the District Commissioners a plan for the proposed new Anacostia bridge. The plans provide for a span of 800 ft., the bridge to be 20 ft. clear above low tide and to cost about $250,000.

RAILROAD LAW—NOTES OF DECISIONS.

Powers, Liabilities and Regulation of Railroads.

In the Federal Court it appeared that under its charter the Council of the City of Ft. Worth is empowered to direct the use and regulate the speed of locomotive engines in said city, or to prevent or prohibit the use or running of the same within the city. The Court holds that the City Council were athorized under this section to enact an ordinance prohibiting the running of an engine or car in said city without a bell attached thereto being rung before starting, and all the time the same should be in motion within such city.[1]

In Texas the Supreme Court decides that under a statute authorizing railroad companies to construct across a highway which the route of the railroad intersects, but requiring it to restore the highway to such state as not to unnecessarily impair its usefulness, a railroad company is bound to provide a crossing at or near the point of its track's intersection with a road only in case the road is a highway, and the fact that it has been used for over 20 years by the public is not sufficient to show a highway by dedication in a country where every one feels at liberty to pass at will over all uninclosed lands.[2]

In Kentucky on a trial for forcibly breaking and entering a railroad car the evidence showed that the car was broken open and a barrel of whiskey opened; that defendants were stealing a ride on the train and were drunk when arrested. Defendants admitted that they were in the car, but stated that they found it broken open and in possession of other drunken men. The Court of Appeals holds that the evidence was sufficient for a conviction.[3]

The Supreme Court of Florida decides that the conferring of authority upon the railroad commissioners of this state by the railroad commission act (Laws, c. 3,746) to make and fix reasonable and just rates for the transportation of freight and passengers over the railroads doing business in this state, is not unconstitutional, on the ground that it is the exercise of personal or legislative power which cannot be delegated.[4]

The Supreme Court of Illinois rules that several railroad companies composing a traffic association are severally, as well as jointly, liable for injuries received by an employé of the association on account of its negligence.[5]

In New York a city authorized a railroad to construct its railroad through a certain street, and authorized and required it also to construct an embankment along a cross street, so as to carry public travel on the said

street over the railroad. The city, it appeared, had no authority to authorize the construction of the railroad; and the formal proceedings prescribed by the charter, before a change of grade could be made on any street, were not taken as to the embankment. The Supreme Court rules that owing to the unauthorized construction of the railroad, and the failure of the steps essential to effect a change of grade, the attempted delegation of authority on the part of the city was not effectual to protect the railroad in the construction of the embankment from damages to abutting property shut out thereby from the street.[6]

The Federal Court holds that where one railroad company owns substantially all the stock and bonds of another railroad company, a lease of the latter's line for rent to be paid to the former company is not void for want of consideration, since the rent goes to the real owner.[7]

The Supreme Court of Michigan rules that a railroad company is entitled to compensation for the expense of erecting safety gates at a crossing of a boulevard extension over its tracks.[8]

The Federal Court rules that the general rule that a railroad company must itself exercise its powers does not render *ultra vires* a contract by the Union Pacific whereby, for 999 years, it let another company into the joint use and occupancy of its bridge across the Missouri river, and of its terminal facilities at Omaha, together with about seven miles of its track, when such joint use does not interfere with the present or prospective use thereof by the lessor, or with the discharge of the duties it owes to the government under the provisions of its charter.[9]

In New Jersey it is laid down that where a railroad company, in violation of statute, leases all its rights, property and franchises, including 40 auxiliary roads leased or controlled by it, to a foreign railroad corporation for 999 years, making the lessee, with other roads controlled by it, constitute a consolidation of three out of six of the great coal carriers from the coal regions of Pennsylvania and adjoining states, the lessor and lessee owning the major portion of the capital stock of corporations which own more than one-half of the anthracite coal fields of Pennsylvania, and the consolidation tending to create a monopoly in coal, and to raise the price of that commodity, equity will, at the suit of the Attorney General, restrain the performance of the lease.[10]

Carriage of Goods and Injuries to Property.

In Arkansas the Supreme Court holds that a statute providing that all carriers shall surrender freight on payment of the charges specified in the bill of lading, does not apply to a connecting carrier which has neither made, authorized nor adopted the bill of lading.[11]

In the Federal Court, a railroad agreed with a marble company to carry marble from T. to M. and allow same to be stopped over at N., an intermediate point, to be dressed, and then reshipped and carried to M. without extra charge, the entire charge for freight being paid in advance. The Court decides that a receiver appointed in a suit by the bondholders to foreclose a mortgage on the railroad could not be compelled to transport marble from N. to M., although the freight had been paid for such transportation before the appointment of the receiver.[12]

The Supreme Court of Alabama holds that the fact that a railroad train was eqipped with the most approved appliances, and in charge of a competent engineer, who was unable, after discovering stock on the track, to stop the train in time to save it, does not relieve the company from liability for killing the stock, unless a proper lookout was maintained to discover the stock as soon as possible.[13]

Injuries to Passengers, Employes and Strangers.

The Supreme Court of New York rules that one who goes on a railroad crossing while the smoke left by a passing train obscures her vision is guilty of contributory negligence, and cannot recover damages for an injury caused by another train.[14]

In Texas it was alleged that the accident was caused by defendant's negligence (1) in the construction of a bridge, and (2) in its failure to properly inspect the same after a washout, and thereby discover its unsafe condition. It was shown that a portion of the bridge was washed away by a rainstorm; that the section foreman and men on whom devolved the duty of inspecting it, though provided with appliances and means with which to have discovered the washout and prevented the accident, did not do so, and took no precautionary measures; and that the conductor was ordered to run the train over the bridge. The Supreme Court holds that plaintiff could recover for defendant's negligence in failing to discover the washout, regardless of the negligent construction of the bridge.[15]

In Kentucky the evidence showed that plaintiff, when approaching the crossing, was driving his cart in a "sweeping trot," and did not stop, listen or look along the track in but one direction; that it was "blustering, windy, and dusty"; that defendant's train was moving at the rate of 15 or 16 miles an hour, and no signal, by bell or whistle, was given of its approach. The Court of Appeals holds the railroad liable.[16]

In Kansas the Supreme Court rules that where a railroad builds its road through a fenced pasture, and fails to erect and maintain cattle guards at the entrance and exit of its road to and from the pasture, as required by statute, the owner may recover damages for the loss of the pasture, or, if he puts his animals therein, to reasonable compensation for his efforts in preventing them from straying from the pasture, and injuring the crops on his own premises, or from trespassing on the lands of other persons.[17]

The Supreme Court of New York holds that, the state statute making a railroad corporation liable for damages done by its engines or agents to animals on the railroad through non-maintenance of a necessary fence to its road, the death of such animal must be the result of its being struck by the engine, and not of its jumping off the track on the engine's approach.[18]

In Maine the Supreme Court holds that where the owner of land across which another has a right of way obstructs the same, but opens another convenient way in its stead, the owner of the easement, if he refuses to use the new way for some time before finally adopting it, because of an impression that by using it he would recognize a right in the landowner to make the change, cannot recover damages sustained by reason of such non-user, since the law makes it incumbent on a person for whose injury another is responsible to take all reasonable measures to avoid the loss and render the damage as light as practicable, and will not permit him to recover any damage which might have been prevented by the exercise of ordinary care and diligence.[19]

The Supreme Court of Minnesota rules that where sectionmen of a railroad company, while acting within the scope of the ordinary duties of such servants, and for the purpose of performing such duties, so negligently set a fire on the company's right of way that it spreads to and burns adjacent property, the company is liable in an action by the owner of the property.[20]

[1] Tex. & P. Ry. Co. v. Nelson, 50 Fed. Rep., 844.
[2] Gulf C. & S. F. Ry. Co. v. Montgomery, 19 S. W. Rep., 1,015.
[3] Boyer v. Com., 18 S. W. Rep., 815.
[4] Storrs v. P. & A. R. Co., 11 South Rep., 226.
[5] Wis. Cent. R. Co. v. Ross, 31 N. E. Rep., 412.
[6] Rawsteen v. N. Y., L. E. & W. R. Co., 19 S. W. Rep., 833.
[7] U. P. R. Co. v. C., R. I. & P. R. Co., 51 Fed. Rep., 309.
[8] Commiss. v. D. G. H. & M. R. Co., 52 N. W. Rep., 1083.
[9] U. P. R. Co. v. C., R. I. & P. R. Co., 51 Fed. Rep., 307.
[10] Stockton v. Central R. Co., 24 Atl. Rep., 354.
[11] Loewenberg v. A. & L. Ry Co., 19 S. W. Rep., 1051.
[12] Cent. Trust Co. v. M. & N. G. R. Co., 51 Fed. Rep., 15.
[13] M. & B. Ry. Co. v. Kimbrough, 11 South. Rep., 307.
[14] McNamara v. N. Y. C., 19 N. Y. (Supt.) 497.
[15] St. Louis & S. F. R. Co. v. George, 19 S. W. Rep., 1036.
[16] Ramsay v. L. C. & L. R. Co., 20 S. W. Rep., 164.
[17] Nelson v. St. L. & S. F. R. Co., 30 Pac. Rep., 178.
[18] Hyatt v. N. Y., L. E. & W. R. Co., 19 N. Y. S., 461.
[19] Fitzpatrick v. B. & M. R. R., 24 Atl. Rep., 432.
[20] Gould v. N. P. R. Co. (Minn.), 52 N. W., Rep., 924.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Boston & Lowell, semi-annual, 3½ per cent., payable Jan. 2.
Canada Southern, semi-annual, 1½ per cent., payable Feb. 1.
Chicago, Rock Island & Pacific, quarterly, 1 per cent., payable Feb. 1.
Lake Shore & Michigan Southern, semi-annual, 3 per cent., payable Feb. 1.
Michigan Central, semi-annual, 3 per cent., and payable Feb. 1.
Petersburg, annual, 3 per cent. on the common and preferred stock, payable Jan. 3
Richmond, Fredericksburg & Potomac, semi-annual, 3½ per cent., payable Jan. 2.
Richmond & Petersburg, semi-annual, 3½ per cent., payable Jan. 3.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Barclay, special, Philadelphia, Jan. 16.
Boston & Lowell, annual, Boston, Mass., Jan. 4.
Brooklyn Elevated, annual, Brooklyn, N. Y., Jan. 4.
Cleveland & Pittsburgh, annual, Cleveland, O., Jan. 4.
East Broad Top Railroad & Coal Co., annual, Philadelphia, Pa., Jan. 9.
East Mahanoy, annual, Philadelphia, Pa., Jan. 9.
Indiana, Illinois & Iowa, annual, Kankakee, Ill., Jan. 18.
Kingston & Pembroke, special, Kingston, Ont., Dec. 31, to authorize the issue of first preference five per cent. bonds.
Malone & St Lawrence, special, New York City, Jan. 16, to take action upon a proposition to lease the road to the Central Vermont.
Philadelphia & Reading, annual, Philadelphia, Pa., Jan. 9.
Philadelphia, Wilmington & Baltimore, annual, Wilmington, Del., Jan. 9.
Pickering Valley, annual, Philadelphia, Pa., Jan. 9.
Terre Haute & Peoria, annual, Decatur, Ill., Jan. 18.
Texas, Sabine Valley & Northwestern, special, Longview, Tex., Feb. 13, to increase the capital stock.
Toledo & Ohio Central, special, Toledo, O., Dec. 31.
Western New York & Pennsylvania, annual, Philadelphia, Pa., Jan. 9.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *New England Railroad Club* holds regular meetings at the United States Hotel, Beach street, Boston, Mass., on the second Wednesday of each alternate month, commencing January.

The *Western Railway Club* holds regular meetings on the third Tuesday in each month, except June, July and August, at the rooms of the Central Traffic Association in the Rookery Building, Chicago, at 2 p. m.

The *New York Railroad Club* holds regular meetings on the third Thursday in each month, at 7:30 p. m., at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, N. Y.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, the fourth Wednesday of January, March, May, September and November.

The *Northwest Railroad Club* meets on the first Saturday of each month, except June, July and August, in the St. Paul Union Station, at 7:30 p. m.

The *Northwestern Track and Bridge Association* meets on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m. in the directors' room of the St. Paul Union Station.

The *American Society of Civil Engineers* holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third street, New York.

The *Boston Society of Civil Engineers* holds its regular meetings at Wesleyan Hall, Bromfield street, Boston, at 7:30 p. m., on the third Wednesday in each month.

The *Western Society of Engineers* holds its regular meetings at 78 La Salle street, Chicago, at 8 p. m., on the first Wednesday in each month.

The *Engineers' Club of St. Louis* holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive streets, St. Louis, on the first and third Wednesday in each month.

The *Engineers' Club of Philadelphia* holds regular meetings at the House of the Club, 1,122 Girard street, Philadelphia, on the first and third Saturday of each month. The annual meeting is held on the third Saturday in January.

The *Engineers' Society of Western Pennsylvania* holds regular meetings on the third Tuesday in each month, at 7:30 p. m., at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa.

The *Engineers' Club of Cincinnati* holds its regular meetings at 8 p. m. on the third Thursday of each month in the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati.

The *Civil Engineers' Club of Cleveland* holds regular meetings on the second Tuesday of each month, at 8 p. m., in the Case Library Building, Cleveland. Semi monthly meetings are held on the fourth Tuesday of the month.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The *Engineering Association of the South* holds its monthly meetings on the second Thursday at 8 p. m. The Association headquarters are at Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The *Denver Society of Civil Engineers and Architects* holds regular meetings at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesday of each month, at 8 o'clock p. m., except during June, July and August, when they are held on the second Tuesday only.

The *Civil Engineers' Society of St. Paul* meets at St. Paul, Minn., on the first Monday in each month.

The *Montana Society of Civil Engineers* meets at Helena, Mont., at 7:30 p. m., on the third Saturday in each month.

The *Civil Engineers' Association of Kansas* holds regular meetings at Wichita on the second Wednesday of each month at 7:30 p. m.

The *American Society of Swedish Engineers* holds meetingsat the club house, 250 Union street, Brooklyn, N. Y., and at 347 North Ninth street, Philadelphia, on the first Saturday of each month.

The *Engineers' Club of Minneapolis* meets the first Thursday of each month in the Public Library Building, Minneapolis, Minn.

The *Canadian Society of Civil Engineers* holds regular meetings at its rooms, 112 Mansfield street, Montreal, P. Que., every alternate Thursday except during the months of June, July, August and September.

The *Association of Civil Engineers of Dallas* meets at 803 Commerce street, Dallas, Tex., on the first Friday of each month at 4 o'clock p. m.

The *Technical Society of the Pacific Coast* holds regular meetings at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., at 8 o'clock p. m. on the first Friday of each month.

The *Tacoma Society of Civil Engineers and Architects* holds regular meetings on the third Friday of each month, in its rooms, 201 and 202 Washington Building, Tacoma, Wash.

The *Association of Engineers of Virginia* holds regular meetings at Roanoke, on the second Saturday in each month, at 8 p. m., except the months of July and August.

The *Engineers' and Architects' Club of Louisville* holds regular meetings on the second Thursday of each month, at 8 o'clock p. m., at its rooms in the Norton Building, Louisville, Ky.

American Society of Civil Engineers.

The Fortieth Annual Meeting of the society will be held in New York, beginning Wednesday, Jan. 18th, 1893, at 10 o'clock. The annual reports will be presented, officers for the ensuing year elected, reports of special committees presented and other business transacted. Thursday will be devoted to excursions; and arrangements for these and for the evenings of both Wednesday and Thursday, are in the hands of a Committee, and will be announced at a later date.

The Civil Engineers' Club of Cleveland.

The club met at its club rooms Dec. 13. Resolutions on the death of Zenos King were adopted. The following amendment to the Constitution was also adopted: Any member of any other society in the Association of Engineering Societies in good standing may become a member of this club when duly elected as described in Art. 3, without paying the initiation fee, and with a release from the annual dues for such period, not over one year, as he may show by certificate he has paid in advance in the society from which he comes.

Mr. James Richie read a short paper on "Cross Ties on Railroad Bridges," and Mr. William W. Sabin read a paper on "Fire Resisting Construction." This paper dealt with the methods of fireproof and slow-burning construction in use at the present day. The protection of columns and girders was briefly described, but the construction of the various types of floors, and partitions was entered into in detail, and illustrated with diagrams at full size, and photographs of the different constructions in various stages of completion. Special notice was drawn to the efforts of the inventors to lighten the weight of the floors and thereby reduce the expense of the constructional ironwork. The paper closed with a statement of the weights and cost per square foot of the different styles of floors and partitions.

The Technical Conventions.

The next annual conventions of the Master Car Builders and Master Mechanics Associations will be held at Lakewood, Chautauqua Lakh, N. Y. The Sterlingworth Inn and the Kent House are the two hotels which will accommodate the conventions.

PERSONAL.

—Mr. E. E. Jaycox, Traffic Manager of the World's Fair, has resigned his position.

—Mr. J. H. Best, Traffic Manager of the Quincy, Omaha & Kansas City, with headquarters at Quincy, Ill., has resigned.

—Mr. L. P. Richardson, Assistant General Agent of the Great Northern, and for four years private secretary to President Hill, has resigned and will engage in business in Spokane, Wash.

—Mr. W. V. Newlin, late General Freight and Passenger Agent of the Fort Worth & Denver, has accepted the position of Traffic Manager of the Earl Fruit Co., of Los Angeles and Sacramento, Cal., with headquarters at Los Angeles.

—President Roberts of the Pennsylvania Railroad has ordered that, until further notice, duties performed by Mr. J. N. Du Barry, late Second Vice President, in connection with the treasury and insurance departments of the company, will be performed by Mr. John P. Green, Third Vice-President. The duties of the second vice-president in connection with the construction department of the company will, until further notice, be performed by Mr. Samuel Rea, assistant to the president.

—Mr. S. Y. McNair, assistant to the auditor of the East Tennessee, Virginia & Georgia Railway, has resigned that position to take effect Jan. 1. Mr. McNair has had a long and honorable record as railroad accounting officer. He was some years in this department of the Erie under the Third Vice-President, and on the organization of the Western Traffic Association he went to Chicago as Auditor and Statistican of that body. On the breaking up of the Association he took the position which he has now resigned.

—Mr. J. E. Rose, Superintendent of Transportation of the Cleveland, Cincinnati, Chicago & St. Louis, has resigned that position, and it is reported will be succeeded by Superintendent William Gibson, of the Cincinnati Division. Mr. Rose was formerly Superintendent of the Baltimore & Ohio Southwestern and two years ago became Superintendent of the Cincinnati Division of

the "Big Four," and was afterward appointed Superintendent of Transportation with headquarters at Indianapolis.

—Mr. Christopher E. Wurtele, Superintendent of the Wyoming Division of the Union Pacific, resigned last week on account of ill health, and Mr. L. Malley, Assistant Superintendent, has been appointed Acting Superintendent. Mr. Wurtele has been connected with the Union Pacific for over 20 years, and has been Division Superintendent since 1882 except for about two years. He entered railroad service as a telegraph operator on the Grand Trunk and joined the Union Pacific service in that capacity in 1869. He was Chief Train Dispatcher of the Western Division for over 11 years, until 1884, when he was appointed Superintendent of that division; later he was appointed Superintendent of the Wyoming Division, a position which he held until 1889, when he resigned, being reappointed early in 1891.

—Mr. Rudolph V. Martinsen, formerly President of the Missouri, Kansas & Texas, died in New York City, Dec. 23. He was the agent in this country of a Holland syndicate, which had large investments in several railroads and various financial concerns, and Mr. Martinsen thus became interested in many corporations. He came to this country in 1877 as a representative of the banking firm of Adolph Rossevain & Co. He retired from the firm in 1881, and since that time has been closely connected with Dutch financial institutions, and represented the Dutch interest in the financial syndicate which aided in building the Canadian Pacific. He was a director of that company for over five years, and he was also Director of the Maxwell Land Grant Co., of New Mexico, and of the Missouri, Kansas & Texas, of which he was elected President in 1888, holding that office for 18 months.

—Mr. H. Stanley Goodwin died suddenly at his home in Bethlehem, Pa., early on Christmas morning, at the age of 60. He went to bed the night before in apparent good health, and his death is attributed to heart disease.

Mr. Goodwin's death is a distinct loss to the world. He was an engineer of excellent standing, a railroad officer of long experience and more than usual ability, and when we say he was a Christian gentleman we speak with full appreciation of the meaning of the term. Notwithstanding Mr. Goodwin's recognized ability, he will be remembered by his friends particularly for his high character. He was not only a man of strict integrity, but he had a gentle and generous spirit, a high sense of justice and a perpetual devotion to duty. His competent and successful work was only one side of his life. His manly and genial nature endeared him to his friends, and his broad sympathies made of him an active and influential citizen. At the time of his death he was a burgess of South Bethlehem, an office which he had held for 18 consecutive terms; he was a trustee of Lehigh University, of St. Luke's Hospital and the Bishop Thorpe School in Bethlehem, and for 25 years had been a vestryman of the Church of the Nativity of that place. He was also a member of the American Society of Civil Engineers, President of the American Society of Railroad Superintendents, Member of the Executive Committee of the American Railway Association and General Eastern Superintendent of the Philadelphia & Reading system.

Mr. Goodwin began his railroad career in 1852 as a rodman on the Delaware, Lackawanna & Western. He became Chief Assistant Engineer of that road in June, 1853, and held that position until March, 1857. For a year after that he was the principal Assistant Engineer of the Honduras Interoceanic Railway. From November, 1858, to June, 1860, he was Resident Engineer of the Western division of the Pittsburgh, Fort Wayne & Chicago. During the early years of the war he was Superintendent of the Catawissa. From April, 1863, to April, 1866, he was the Chief Engineer of the Northern Central. He then moved to Bethlehem, and from April, 1866, to December, 1882, was Eastern Superintendent of the Lehigh Valley. For the last ten years he was General Superintendant of that system.

ELECTIONS AND APPOINTMENTS.

Alabama Great Southern.—M. A. Zook, formerly Roadmaster between Chattanooga and Birmingham, has been appointed Engineer of Maintenance of Way of the entire road. There have heretofore been two divisions, in charge of the Roadmasters, M. A. Zook being Roadmaster of the Northern Division and P. Nolan, Roadmaster between Birmingham and Meridian. That office has now been abolished.

Chattanooga Southern.—At a meeting in Chattanooga last week, new directors were elected, a majority representing the Post reorganization committee, also interested in the reorganization of the Mariett & North Georgia road. Newman Erb, William Edward Coffin and Mr. Gleason, all of New York, were elected members of the Board of Directors. John W. James, of Chattanooga, was re-elected President.

Chicago, St. Paul, Minneapolis & Omaha.—A. W. Trenholm has been appointed Superintendent of the Northern division, with headquarters at Spooner, Wis.

Evansville & Terre Haute.—The following appointments are announced: W. M. Corbett, Superintendent in charge of the Operating, Mechanical and Maintenance of Way Departments; H. E. Felton, General Freight Agent, and S. D. McLeish, General Passenger and Ticket Agent, vice E. O. Hopkins, General Freight Agent, and R. A. Campbell, General Passenger Agent, who have resigned to accept other duties.

Kansas City, Fort Scott & Memphis.—The following changes in the freight department are effective Jan. 1: C. W. Cheare, Assistant General Freight Agent, office removed from Memphis to Birmingham. He will have charge of the territory formerly under the jurisdiction of L. R. Van Divier, Commercial Agent at Atlanta, and L. Jacobs, Commercial Agent at Birmingham, resigned. J. J. Fagan, Commercial Agent, St. Louis, transferred to Memphis with the same title, succeeding M. G. McManama, resigned.

Kansas City, Osceola & Southern.—B. S. Josselyn has been appointed General Manager, with headquarters at Kansas City, Mo., to succeed W. E. Gray, who resigned to become Superintendent of Transportation of the Chicago & Alton.

Lake Street Elevated (Chicago).—This road has passed into the control of Eastern parties, and last week the following new Board of Directors was elected: J. A. Roche, C. H. Deere, William Ziegler, J. Witbeck, Clarence A. Knight, D. W. Campbell and Gilbert B. Shaw. H. P. Thompson and William H. Fitzgerald, of the old directory, remain on the directory for the present. John A. Roche has been elected President, and H. P. Thompson Vice-President.

Maine Central.—At the annual meeting at Portland, Me., Dec. 21, the following directors were elected: Arthur Sewall, Bath; A. A. McLeod, Philadelphia; Frank Jones, C. A. Sinclair, Portsmouth, N. H.; S. C. Lawrence, Medford, Mass.; J. S. Ricker, Deering, Me.; G. M. Pullman, Chicago; Payson Tucker and W. G. Davis, Portland, Me.; W. T. Hart, Boston; T. W. Hyde, Bath, Me.; Amos Paul, South Newmarket, N. H.; John Ware, Waterville, Me.; F. A. Wilson, Bangor, Me.; F. W. Hill, Exeter, Me. The new directors are Messrs. McLeod, Pullman, Wilson and Hill.

Marietta & North Georgia.—At the adjourned annual meeting of the stockholders, held at Knoxville, Dec. 21, the following directors were elected: H. A. V. Post, Thomas Carmichael, Newman Erb, Wm. E. Coffin, of New York; J. C. Luttrell, of Knoxville; George R. Eager, Lenox Smith and George F. Newell, of New York. The first five named constitute the reorganization committee of bondholders.

Minneapolis & St. Louis.—Edwin Hawley, Assistant General Traffic Manager of the Southern Pacific, has been elected a director of this Company.

Paducah, Tennessee & Alabama.—The directors met in St. Louis last week and elected the following officers: T. J. Moss, President, Thos. H. West, Vice-President and Chairman of the Board; T. H. Purvear, Second Vice-President; James W. Harrison, Treasurer; J. W. Fristoe, Secretary P. T. & A., and F. P. Jones, Secretary Tennessee Midland. John Overton is Vice-President of the Tennessee Midland, which is leased by this company.

Pennsylvania.—President Roberts last week issued the following order: Until further orders the duties performed by J. N. Du Barry, late Second Vice-President, in connection with the treasury and insurance departments, will be performed by John P. Green, Third Vice-President. The duties of the Second Vice President, in connection with the construction department of the company, will until further notice be performed by Samuel Rea, assistant to the President.

Phœnix, Mt. Olive & Mesa.—The following are the officers of this company already reported as organized: B. E. Lower, President; Chas. V. Barr, Vice-President; Warwick Scott, Secretary, and T. W. Hine, Treasurer.

Savannah, Americus & Montgomery.—J. C. McKenzie, formerly trainmaster of the Western of Alabama, also Superintendent of the Southwestern division of the Central of Georgia, and trainmaster of the Columbus Southern, has been appointed trainmaster of this road, with headquarters at Americus, Ga.

Texas & Pacific.—The directors have elected George J. Gould President of the company, to fill the vacancy caused by the death of Jay Gould.

RAILROAD CONSTRUCTION.

Incorporations, Surveys, Etc.

Baltimore & Ohio.—Work on the extension of the State Line road and the Fairmont, Morgantown & Pittsburg, which together are to close up the gap between the Connellsville, Pa., division of the Baltimore & Ohio, and its main line in West Virginia, by way of Morgantown, W. Va., and Smithfield, Pa., is being pushed forward as well as winter weather will permit. The State Line road was opened to Smithfield Dec. 15, and three daily trains are now running. No stations have been built along the road, and all arrangements are temporary. From Smithfield to Point Marion, Bennet & Talbot have 400 men at work grading and ballasting. They also have the tunnel work at Morris Cross Roads, which cannot be completed before early spring. From Morgantown to Point Marion, the work is well under way, and is ahead of other divisions. Gangs of men are ballasting from both ends of this division. The bridge over Cluot River is beyond the reach of high water. This structure will be very substantial, the stonework being unusually heavy. It has not been decided yet where tracklaying on the remaining portion of the road will begin, but it will probably be about Jan. 15. There is ample time yet to begin tracklaying, and finish before the bridge and tunnel are completed.

Chesapeake & Ohio.—This company is pushing its work in the Greenbrier (W. Va.) Valley. The improvements of the main line have reached this point and large forces of laborers are employed. The long and high trestle across the mouth of Big Creek is to be filled in and the same work will be done at several other trestles in the same vicinity. At Little Bend tunnel, the hill will be removed and a cut made instead. The work on the branches up Twenty Mile and Laup creeks is being pushed rapidly.

Chicago & Mississippi River.—Articles of incorporation have been filed in Illinois by this company. It is proposed to build a road from Chicago to a point on the Mississippi River in Mercer County, and from a point in Stark County to the Mississippi River in Pike County. The principal office is to be in Chicago. The incorporators are: D. W. McCord, S. M. Dunton, N. J. McMillan, G. F. Tibbitts and C. M. Lahm, all of Chicago.

Clarksville Mineral.—This branch was opened last week its entire length when an excursion was run between Pond Station near Dickson to Clarksville, Tenn., on the Memphis line of the Louisville & Nashville. The distance between these points is 30 miles, and all the track was laid in 1891, except about seven miles on the middle portion of the road between Marion and Van Leer, which was completed this year.

Colorado Midland.—General Manager Colbran last week closed a contract with the Colorado Fuel & Iron Co. for the rails for the Cripple Creek branch now nearly all graded. The portion of this line being built by this company is from a point on its main line called Divide, north to the new town of Midland, eight miles. Price & McGavock are the contractors.

Columbia Railway & Navigation Co.—Sealed proposals were received this week for the construction of the Portage road of this company on the Washington side of the Columbia River, from Columbus to the western terminus (opposite Crate's Point), a distance of 22 miles, including grading, bridging, tracklaying and ballasting. Rock excavation to be commenced by Jan. 15, and to be completed by May 15, 1893, and all remaining work is to be completed by July 15, 1893. Emery Oliver, The Dalles, Or., is Chief Engineer. Paul F. Mohr is President.

Crystal River.—The grading has been completed on the branch between Coal Creek and Coal Basin, Col., a distance of about 11 miles, and Orman & Crook of Pueblo, Col., the contractors, are removing their grading forces to the main line near Carbondale, Col. The main line is about 17 miles long between Carbondale and Coal Creek. Surveys have been made from Coal Creek to Crystal and Yule Creek about 22 miles. J. A. Kebler, of Denver, is General Manager of the road, which is being built by the Colorado Fuel Co.

Cumberland.—The Secretary of State of West Virginia, on Dec. 24, issued a certificate of incorporation to this company, with a capital stock of $100,000, for the purpose of building a road beginning at a point in West Virginia, on the Piedmont & Cumberland, near Cumberland, Md., through the counties of Mineral, Grant and Hardy, W. Va., to a point near Moorefield, Hardy County. The principal office will be at Keyser, Mineral County, W. Va. The incorporators are: James A. Millholland, C. A. Wilson, E. W. S. Moore and Hopewell Hebb, of Cumberland, Md.; James Parsons, of Davis, W. Va., and T. B Davis, of Keyser, of W. Va. Several of the incorporators are connected with the West Virginia Central & Pittsburgh. E. W. S. Moore is Secretary of that company and James Parsons is the engineer.

Duluth & Iron Range.—The contract for building a nine-mile extension of the Mesaba branch from McKinley to Virginia has been awarded to Winston Brothers of Minneapolis. Two engineering corps consisting of 32 men are now in the field locating another line between the Mesaba range and a point on the main line between Duluth and Two Harbors. It is the intention of the company to build the new line to the Mesaba range next season and the contracts will be let as soon as the engineers complete the work of locating the line.

Duluth, Mesaba & Northern.—Engineers are now in the field locating a line from Stony Brook Junction to Duluth. The officials of the railroad company state that they will complete the road to Duluth and expend $500,000 in docks and terminals, if the city will secure the right of way into the city and the dock location for them. It is claimed that a very light grade for the line has been found, and that the cost of building will be much less than is usual in this section of Minnesota.

The route of the new line extends from Oneota near Duluth to a point six miles north of Stony Brook Junction, Minn. It will be 24 miles in length and will shorten the distance from the mines to the lake 17 miles. Work will be begun this winter. The same road will build at Oneota two ore docks each 1,500 ft. long, containing 500 pockets with aggregate capacity of 90,000 tons.

Gulf of Mexico & Tennessee.—The Secretary of State at Nashville, Tenn., has issued a charter for this road, projected to extend from Jackson, Madison County, to Middleton, Hardeman County, where it will cross the Memphis & Charleston and connect with the Gulf & Chicago road. It is said that work will begin on the new road at once.

Kishacoquillas Valley.—This road will probably be opened for business Jan. 15, 1893, as far as Alexanders, five miles, and if weather permits will be opened for business to Belleville, nine miles, by Feb. 15. Four miles of track has been laid during the year since Sept. 30. E. A. Tennis, the contractor, has 200 men at work and is pushing the work rapidly forward. The heavy work is nearly all completed and the remainder will soon be graded, and the different gangs of workmen connect their respective sections. F. F. Whittekin, of Belleville, Pa., is Chief Engineer.

New Haven & Dunbar.—The charter for this company was issued at Harrisburg on Dec. 27. The road is to extend from a point on Dunbar Creek, in Dunbar Township, near the railroad of the Dunbar Furnace Co.; thence northerly along Dunbar Creek, four miles, to the Borough of New Haven, near the Pittsburgh, McKeesport & Youghiogheny road. The capital stock is $40,000. Frank A. Hill, of Dunbar, is the President, and C. H. Kimball, Harry Cook and Buell Tarr, all of Dunbar, are the directors.

New Roads.—A lumber firm is building a narrow gauge extension, to be operated by a Climax engine, into the coal and lumber districts of Menifee County, Ky., and leaving the Kentucky & South Atlantic at Rothwell. Ten miles of track has been graded and about five miles of track laid. The maximum grade is 11 per cent. and there are 14 switch-backs.

Pittsburgh & Western.—The contractor for the new branch from Hazleton through Youngstown to Niles, O., has his outfit at Youngstown and will begin grading at once. The river will be bridged at Hazleton and the new line will connect with the plants of the American Tube & Iron Co. and the Ohio Iron & Steel Co. It will rejoin the main line at Niles.

Point Pleasant, Buckhannon & Tygarts Valley.—This company was chartered in West Virginia on Dec. 24, with a capital stock of $1,000,000. It proposes to construct a road from a connection with the Baltimore & Ohio and West Virginia Central & Pittsburgh roads at Belington, Barbour county, W. Va., through Barbour and Upshur counties to Buckhannon; thence through Lewis, Braxton, Gilmer, Calhoun, Roane and Jackson counties to Point Pleasant, Mason county and to a connection with the Kanawha & Michigan and Ohio River roads. The incorporators are: James H. Hanson, Jacob W. Heavener, John L. Hirsh, Jacob G. Hall, Samuel C. Rusmisel, John A. Crislip, Thomas S. Farnsworth, William Post, Crede W. Hart, and W. G. L. Latlon, of Buckhannon, W. Va., and Charles J. Goff, of Clarksburg, W. Va. The incorporators are business men interested in the development of the territory covered by the route.

Port Arthur, Duluth & Western.—The Government engineers are making an inspection of the last section of this road in Ontario, which has just been completed. The line built this year is from a point near North Lake to Gunflint Lake at the Minnesota State Line and to iron mines, about six miles south of the boundary, the total distance being 16 miles. The road was built by Middleton & Conmee, of Port Arthur, Ont. The total length of the line from Port Arthur is over 80 miles. Most of this distance has been in operation during 1892.

Salt Lake & Deep Creek.—Articles of incorporation of the road were filed at Salt Lake City last week. The road is to connect Salt Lake City and Muncey, in White Pine County, Nev., a distance of 230 miles. The capital stock is $4,400,000, which, it is reported, has been subscribed largely by New York capitalists.

Toledo, Walhonding Valley & Ohio.—It is announced that this road, which was built by the Pennsylvania, will be opened for traffic on Jan. 1, and will be operated as the Mansfield & Coshocton Branch of the

Ft. Wayne road. The new road is 46 miles long and extends from Loudonville to Coshocton, O., and, as already stated, gives the Pennsylvania a more direct line between the Ohio coal fields and Toledo. It is proposed to extend the line from its present southern terminus at Coshocton, where it connects with the Panhandle road, southeast across Ohio to the Ohio River, connecting with the Pittsburgh, Ohio Valley & Cincinnati road, also a new line of the Pennsylvania, the distance being about 85 miles. The surveys, however, have not been made.

Wheeling & Lake Erie.—The directors have instructed C. A. Wilson, Chief Engineer, to proceed as rapidly as practicable to build an extension from the present terminus at the junction of the Wheeling Bridge & Terminal line, at Martin's Ferry, O., to a point on the Ohio River at Altuaville, three miles below. The object of the extension is to secure for the company access to about 20 large manufacturing establishments facing the Ohio River along the route named. There is no available route along which to build the line except outside the Ohio River bank or along the streets of Martin's Ferry. This later route has been denied by the city council to other companies, and the Cleveland, Lorain & Wheeling road occupies the former route. It will be necessary to build the road on trestles a good part of the way, in the river, outside the Cleveland, Lorain & Wheeling tracks, which are built on trestles part of the way. Agents are now at work securing the right of way for the Wheeling & Lake Erie, and the work will begin soon. It will be a costly piece of road. The completion of this part of the line also covers the most difficult portion of an extension to Bridgeport and Bellaire, two very important points to the Wheeling & Lake Erie.

White Lumber Company.—The W. C. White Lumber Company, of Cumberland, Md., has purchased large timber interests in Rowlesburg, Preston County, W. Va., and along Cheat River, down toward the Pennsylvania state line. This company is surveying for a standard gauge road from Rowlesburg, where it is to connect with the Baltimore & Ohio to a point on Cheat River, seven miles distant. This road will be built to get out the timber of the company and for general traffic.

GENERAL RAILROAD NEWS.

Augusta, Gibson & Sandersville.—The United States Circuit Court at Augusta issued a decree of foreclosure on Dec. 19 in the suit brought by the Central Trust Company. The road is a narrow gauge line from Augusta to Sandersville, Ga., 80 miles, and has been in the Receiver's hands since January, 1892.

Canada Southern.—The contract with the Michigan Central has been modified, and a new apportionment of earnings agreed upon, giving the Canada Southern 40 per cent. and Michigan Central 60 per cent. of the first $1,000,000 of net earnings, any amount over that to be divided on the present basis of one-third and two-thirds. This addition to the Canada Southern's share amounts to ½ per cent. per annum on its capital stock. The contract between the two companies made in 1882 was for 21 years, providing for a division of net earnings, 33⅓ per cent. to the former and 66⅔ per cent. to the latter, with a provision for reapportionment at the end of each five years, leaving the last apportionment to run for six years. The first five years expired in 1887 but no change was made at the time. The next period expires with Dec. 31, 1892.

Cincinnati, Jackson & Mackinaw.—The Common Pleas Court at Cincinnati granted a perpetual injunction last week restraining the Cincinnati, Hamilton & Dayton from leasing the road as proposed, on the ground that they are competing lines. The lease was agreed to by the officers of both companies while the Cincinnati, Jackson & Mackinaw was still in control of the Receiver, and it was opposed by the minority stockholders of the latter road who have brought various suits to prevent the agreement being carried out. The present injunction was obtained in a suit brought by a stockholder of the Cincinnati, Hamilton & Dayton.

Connecticut River.—The special meeting of stockholders which was called to vote upon the proposed lease to the New York, New Haven & Hartford, which had been unanimously approved by the directors, was held at Springfield, Mass., Dec. 23. As anticipated, the stockholders failed to approve the proposed lease, the vote being 14,027 shares against, and 9,308 shares for the lease. The directors have since voted to terminate at once the temporary agreement by which the New Haven Co. is operating the road. It is reported that the directors who are still favorable to the New Haven lease have declined to resign until the annual meeting, which occurs next September. The friends of the Boston & Maine, who purchased a majority of the stock above 300, after the announcement had been made that the directors had agreed to lease the line to the New Haven, will be unable to secure control of the road for nine months, unless these directors are ousted or conclude to resign.

Knoxville, Cumberland Gap & Louisville.—Clarence Cary, of New York City, President of the road, was appointed Receiver at Chattanooga, Tenn., Dec. 20, by the United States Circuit Court. The order was issued in the suit brought by the Central Trust Co., of New York, trustee of the bonds. The amount of the first mortgage bonds is $1,650,000, and of the second mortgage bonds, $50,000. Interest has been defaulted on both of these issues; since Sept. 11, 1892, on the first mortgage bonds issued in 1888, and on the six per cent. mortgage bonds issued in October, 1889, no interest has been paid.

Lake Shore & Michigan Southern.—The report for the year ending Dec. 31, partly estimated, is as follows:

	1892.	1891.	Inc. or Dec.
Gross earnings	$22,450,000	$21,460,000	I. $1,018,614
Oper. exps	15,820,000	14,652,800	I. 1,187,325
Net earnings	$6,630,000	$6,807,200	D. $16 ,711
Fixed charges	3,360,000	3,340,000	D. 80,000
Surplus	$3,270,000	$3,467,200	D. $197,200
Dividends paid	2,967,990	2,967,990	
Surplus	$302,010	$499,210	D. $197,200

The profits for the year were equal to 6.61 per cent. on the stock, against 7.01 per cent. the previous year. There was an increase of 4.54 per cent. in gross earnings and a decrease in net earnings of 2.48 per cent. The gross earnings for the year are the largest in the history of the company. Nothing has been charged to construction or equipment since 1883. The outlays in 1892 for new buildings, second track, new sidings, heavier iron bridges and reductions of grades amounted to $1,015,000. The funded debt has been decreased during the year $250,000 by the operations of the sinking fund.

Mineral Range.—A majority of the stock of this company which amounts to over $300,000 has been purchased by the Duluth, South Shore & Atlantic road. The Mineral Range is 17 miles long from Houghton where it connects with the Duluth, South Shore & Atlantic to Calumet and the Red Jacket mines in the northern peninsula of Michigan.

Prospect Park & Coney Island.—President Austin Corbin has called a special meeting of the stockholders of Long Island to ratify the action of the directors in acquiring control of the majority of the stock of the above road. The road is about 10 miles long from Ninth avenue, Brooklyn, to West Brighton, Coney Island, and has trackage rights over three miles of Long Island from Parkville to Bay Ridge.

Ulster & Delaware.—This company has purchased the Delaware & Otsego roadbed, which is nearly graded from Bloomville, the present terminus of the first road, to within about four miles of Oneonta, N. Y. No work has been done on the road for two years but it may now be completed to Otsego the coming season. The road was projected in the interest of the first road.

Union Pacific.—The statement of earnings for October and the fiscal year to Oct. 31 shows increases in the net earnings for both periods on the entire system, though showing decreases on the Oregon Short Line and Gulf divisions:

OREGON SHORT LINE & UTAH NORTHERN.

October.	1892.	1891.	Inc. or Dec.
Gross earnings	$680,680	$684,734	D. $4,054
Oper. expenses	385,536	397,796	D. 12,260
Net earnings	$295,143	$286,938	I. $8,204
Since Jan. 1.			
Gross earnings	$5,972,648	$6,306,637	D. $333,989
Oper. expenses	3,571,720	3,860,637	D. 288,617
Net earnings	$2,400,928	$2,446,000	D. $45,072

OREGON RAILWAY & NAVIGATION, RAIL LINES.

October.			
Gross earnings	$675,518	$674,986	I. $532
Oper. expenses	311,416	352,020	D. 40,603
Net earnings	$364,101	$322,966	D. $41,135
Since Jan. 1.			
Gross earnings	$3,913,891	$4,701,222	D. $787,331
Oper. expenses	2,727,148	3,092,928	D. 365,780
Net earnings	$1,186,743	$1,608,294	D. $421,551

UNION PACIFIC SYSTEM PROPER.

Month of October.			
Gross earnings	$4,493,263	$4,578,215	D. $84,976
Oper. expenses	2,547,537	2,619,443	D. 71,905
Net earnings	$1,945,731	$1,958,802	D. $13,071
Since Jan. 1.			
Gross earnings	$35,469,591	$34,887,655	I. $581,935
Oper. expenses	22,317,724	22,712,819	D. 395,094
Net earnings	$13,151,866	$12,174,836	I. $977,030

GRAND TOTAL OF UNION PACIFIC SYSTEM.

October.			
Gross earnings	$4,681,513	$4,714,031	D. $32,517
Oper. expenses	2,667,319	2,707,515	D. 40,195
Net earnings	$2,014,194	$2,006,516	I. $7,677
Since Jan. 1.			
Gross earnings	$37,070,445	$35,879,429	I. $1,191,015
Oper. expenses	23,411,301	23 ,34,285	D. 122,894
Net earnings	$13,659,053	$12,345,143	I. $1,313,909

TRAFFIC.

Traffic Notes.

A Kansas City dispatch reports that the Missouri Pacific will abolish unlimited tickets Jan. 1 throughout its lines.

The time of the new night passenger train from New York to Boston over the New York & Northern road has been changed, and it now leaves New York at 11:30 p. m. This week an excursion by this train has been announced, the fare to Boston and back being $5.

The railroads centering in Buffalo have been trying to form a new passenger agreement and it was nearly finished, but it is now said that the New York, Chicago & St. Louis refuses to join, thus destroying the effect of the movement. Buffalo seems to be well supplied with ticket brokers, and irregular tickets are said to be plenty there.

A Virginia newspaper says that the Norfolk & Western will hereafter collect the charges on excess baggage at destination instead of at the starting point. The aim seems to be to put a check upon underbilling and errors, as the sending agent is to weigh the baggage and make a record of the weight as heretofore; but the tag which he attaches will be left blank.

The arrangements for carrying out the agreement to establish differential rates on eastbound freight, whenever necessary, which was agreed upon by the Presidents of the trunk line and central traffic roads Nov. 17, involve a good deal of detail work, and meetings are being held at the important originating points for the purpose of laying out the rules and regulations. The Joint Committee met in New York last week. Messrs. Walker, Goddard and Blanchard went to St. Louis on Thursday of this week and to Cincinnati on Friday.

The report of the State Grain Inspector of Minnesota shows that there were inspected during the year ending Aug. 31, 1892:

Car loads Spring Wheat	199,804
" Winter "	277
" Corn	5,063
" Oats	6,362
" Rye	649
" Flaxseed	5,662
" Barley	3,129
Total	221,546

Press dispatches from Washington state that the Government is making further inquiries concerning freight traffic between this country and Canada. It is claimed that the regulations established in 1864, by which freight comes through from interior Canadian points, in cars sealed by the consuls, without inspection at the border, have been loosened so that freight from China and Japan comes in under them, a use to which the regulations were not intended to be put. The aim of the present agitation seems to be to make it less easy for the Canadian Pacific to get this Asiatic traffic in competition with American trans-Continental roads.

The New York & Pacific Steamship Co., recently formed in London, is to put on a line of steamships between New York and the west coast of South America. It is said that six vessels, from 3,700 to 4,500 tons each, have been ordered in England. This traffic is now taken by sailing vessels. With these the time of transit is irregular, and the business has been small. There are regular lines of steamships to the west coast of South America from England, Germany, France and Italy. The new company hopes to increase the traffic from the United States by making regular, uniform and quicker time. It is said that the venture is made possible only by the very low prices at which ships can be built in England now.

Chicago Traffic Matters.

CHICAGO, Dec. 28, 1892.

It has been decided to call another meeting of general passenger agents of the Chicago lines, probably Jan. 25, to again canvass the lines in regard to establishing a bureau of railroad information on the Exposition grounds during the Fair, and it is claimed the assent of a sufficient number of lines has been secured to render it a success. It is quite probable, however, that this may not prove to be the case when a decisive vote is reached.

The Burlington, now that it is free from the restrictions imposed by the Western Traffic Association, appears determined to establish rates satisfactory to itself under the 10-day rule of the Western Freight Association. It recently attempted to reduce the salt rate from Chicago to St. Paul to 10 cents per 100 lbs., in line with the reductions to Kansas City and Omaha, but Chairman Midgley has ruled the notice to be defective under the rules of the Association. It will be renewed at the next meeting. It has always been contended that reductions to lower Missouri River points and Omaha should not be made the basis for reductions to St. Paul.

Chairman Caldwell, of the Western Passenger Association, has decided in favor of the Chicago Great Western in the matter of a complaint filed against it that the St. Paul delegates to the National Real Estate Dealers' Convention at Buffalo, last October, were secured by that line by the indirect payment of rebates.

The committee having in charge the preparation of a revised agreement to take the place of the present Western Passenger Association agreement have adjourned and will make their report at the next meeting of the association. It is pretty certain that the new agreement to be proposed will be radically different from the present one in many respects.

The various committees of the Central Traffic Association will be called together this week to confer with Chairman Walker and Commissioner Blanchard in regard to carrying into effect the resolutions adopted at New York in regard to eastbound traffic. Members of the Chicago eastbound lines are in session here to-day. It is likely to take some weeks to get the new plan proposed by the presidents in working shape, and these conferences between the interested lines are designed to facilitate a more speedy carrying into effect of the plan.

The Joint Committee have agreed that on all export traffic the full authorized tariff rates shall be maintained to the various ports of export as the inland proportions of the through rates; that in making up through rates to foreign ports, the ocean rates to be added to the inland rates shall be only bona-fide quotations, shall not be influenced by promise or arrangement for future comparison or concession in connection therewith; and that this agreement be maintained regardless of the rates of routes not members of the Joint Committee; but if the rates of the latter disturb the tariff rates the Joint Committee shall be convened for their consideration, pending which no independent action shall be taken.

The first meeting of the committee of general passenger agents of the Western lines, which will consider plans for restricting the payment of commissions on West bound immigrant business, will be held in New York Jan. 10.

The shortage of cars continues at many points with but little change. It is charged that the trouble in the Southwest is largely due to the shipment of large quantities of grain to New England points via St. Louis. Chicago commission houses complain that quotations via the St. Louis gateway completely shut them out of the business and show an eight-cent cut in the rates somewhere.

The question of differentials across Lake Michigan and the transfer of loaded cars across the lake via Kewaunee and Frankfort continues to cause much discussion among the lines interested. The Michigan Central and the Grand Rapids & Indiana roads have reduced the rates via Mackinaw to meet those of the Kewaunee line from St. Paul to the seaboard, and the Chicago & Grand Trunk has joined the Chicago and St. Paul lines in making the same rates via Chicago. The matter has been referred to the officers of the joint committee of the Trunk Line and Central Traffic associations for a ruling.

Imprisonment for Bribing a Freight Weigher.

In the United States Court at St. Joesph, Mo., Dec. 21, Judge Parker sentenced George W. Howell, General Manager of the lumber firm of Howell, Jewett & Co., and Edward Tibbetts, an employé of the firm, to eighteen months at hard labor in the Jefferson City Penitentiary and to pay a fine of $2,000. The judge announced that he would grant a new trial to S. R. Howell, but the prosecuting attorney stated that he had not sufficient evidence to convict him, and the case against him was dismissed. The cases of George W. Howell and Edward Tibbetts were appealed and a stay of execution ordered. Howell's bond was fixed at $5,000 and Tibbetts' at $2,000. They were promptly furnished and the defendants left the courtroom. Howell, Jewett & Co. had lumber yards at Atchison, Omaha, Chicago and in Texas. In the Spring of 1890 the Rock Island road caused the arrest of each member of the firm except, Mr. Jewett, and three employés, Pierce, Mott and Tibbetts, on the charge of bribing weighmasters to underweigh their freight. The cases against Pierce and Mott were dismissed, and they appeared as witnesses for the prosecution. It was proved at the trial of the case in July that money was given to Tibbetts to bribe weighers and switchmen, and the latter received from $1.50 to $3 a car on all cars for which fraudulent weights were reported. Mott and Pierce acknowledge that they accepted money from Tibbetts.

Kansas Commissioners on Salt Rates.

The Kansas Board of Railroad Commissioners has issued a decision in the Hutchinson salt case, holding that the Board is powerless to protect the salt companies against the competition of Michigan salt. The allegation that the railroads charge lower rates on Michigan salt to Kansas points than they charge on Kansas salt to the same points is true, but, as the most of the roads which are complained of do not touch Hutchinson, they cannot be compelled to make a joint tariff on Kansas salt with the two or three roads which do.

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